JANUARY 1921.] [Price 6s.

PROCEEDINGS

OF THE

LINNEAN SOCIETY OF LONDON.

132ND SESSION.

FROM NOVEMBER 1919 TO JUNE 1920.

LONDON:
PRINTED FOR THE LINNEAN SOCIETY,
BURLINGTON HOUSE, PICCADILLY, W.1.
BY TAYLOR AND FRANCIS, RED LION COURT, FLEET STREET.

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CONTENTS.

	Page
List of Publications issued	iv
Proceedings of the 132nd Session	1
Presidential Address	25
Obituaries	37
Abstracts of Papers	59
Benefactions, 1901–1920	66
Additions to the Library	71
Index	81

SUPPLEMENT.

Commemoration of Sir Joseph Banks, Bart., F.R.S.

PUBLICATIONS: Session July 1919–July 1920.

Journal, Botany.

Vol. XLIV.	No. 300.	10/-
„ XLV.	„ 301.	20/-

Journal, Zoology.

Vol. XXXIV.	No. 227.	14/-

Proceedings, 131st Session, October 1919. 6/-

List of [Fellows, Associates, and Foreign Members], Nov. 1919.

PROCEEDINGS

OF THE

LINNEAN SOCIETY OF LONDON.

(ONE HUNDRED AND THIRTY-SECOND SESSION, 1919–1920.)

November 6th, 1919.

Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The Minutes of the General Meeting of the 19th June, 1919, were read and confirmed.

The report of the Donations received since the last Meeting was laid before the Fellows, and the thanks of the Society to the several Donors were ordered.

Miss Florence Annie Mockeridge, D.Sc., was admitted a Fellow.

Certificates in favour of the following were read for the second time:—Mr. Arthur Robert Thompson, Lieut. R.A.F., Miss Mary Ross Hall Thomson, Mr. Humphrey John Denham, B.A.(Oxon.), Mr. Ethelbert Ambrook Southee, Mr. Benaiah Colson Adkin, M.A.(Cantab.), George Parker Bidder, M.A., Sc.D.(Cantab.), Miss Vera Adelaide Irwin-Smith, B.Sc.(Sydney), Mr. James Robert Matthews, and Miss Beatrice Buckland Taylor.

The following were proposed as Fellows:—Mr. Narayanan Padmanabha Panikkar, B.A.(Madr.), James Davidson, D.Sc.(Liverp.), F.E.S., Mr. Sahay Ram Bose, M.A.(Calc.), Mr. Tribhawan Nath Bhan, Thomas Robertson Sim, Hon. D.Sc.(Pretoria), Mr. Frank Henry Taylor, F.E.S., William Rushton Parker, M.A., M.D.(Cantab.), Mr. Jacques de Vilmorin, Mr. Arthur

Lionel Goodday, Lieut. R.G.A., Geoffrey Douglas Hale Carpenter, M.B.E., B.A., D.M.(Oxon.), Mr. Arthur Stanley Hirst, Mr. William Grant Craib, M.A.(Aberd.), Mr. Sydney Percy-Lancaster, and Mr. Herbert William Pugsley, B.A.(Lond.).

The President read the following proposed alterations in the Bye-Laws, for the first time:—

In Chapter II. Sections 2, 3: "That the privilege of Compounding for the Annual Contribution be suspended."

In Chapter XV. Section 3, to leave out the words: "Five years shall have elapsed from." [The whole section stands thus, the words proposed to be left out being in italics:—

"No Fellow of the Society shall be entitled to receive, gratis, any copy of the 'Transactions,' or other serial Publications, after *Five years shall have elapsed from* the Time of their Publication, unless the Council shall otherwise direct."]

The first paper, by Colonel H. E. Rawson, C.B., F.L.S., "Plant-sports produced at will," was illustrated by the Episcope.

Prof. J. B. Farmer and Dr. R. R. Gates discussed the paper, and the Author replied. (See Abstract, p. 64.)

The second paper was by Mr. Lancelot Hogben, B.A., B.Sc., and entitled "Nuclear Phenomena in the Oocytes of *Neuroterus*, a Gall-fly," which was communicated by Dr. Eric Drabble, F.L.S.

Dr. R. R. Gates added a few remarks on the paper.

The last paper, "A Revision of the genus *Baphia*, Afzel.," by Mr. L. V. Lester-Garland, M.A., F.L.S., was summarized by the Author.

Mr. E. G. Baker commented on the geographical distribution of the species.

November 20th, 1919.

Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The Minutes of the General Meeting of the 6th November, 1919, were read and confirmed.

The report of the Donations received since the last Meeting was laid before the Fellows, and the thanks of the Society to the several Donors were ordered.

Mr. Robert Selby Hole, Mr. Alfred William Sheppard, Mr. Humphrey Godwin Billinghurst, and Prof. Robert Colquhoun McLean, M.A., D.Sc., were admitted Fellows.

Mr. Joseph Omer-Cooper and Miss Lucy Ellen Cox were proposed as Fellows.

The Certificate in favour of Mr. Narayanan Padmanabha Panikkar, B.A., was read for the second time.

Mr. Arthur Robert Thompson, Lieut. R.A.F., Miss Mary Ross Hall Thomson, Mr. Humphrey John Denham, B.A. (Oxon.), Mr. Ethelbert Ambrook Southee, Mr. Benaiah Colson Adkin, M.A. (Cantab.), George Parker Bidder, M.A., Sc.D. (Cantab.), Miss Vera Adelaide Irwin-Smith, B.Sc. (Sydney), Mr. James Robert Matthews, M.A. (Edin.), and Miss Beatrice Buckland Taylor were elected Fellows.

The proposed alterations in Chapters II. & XV. of the Bye-Laws were read from the Chair for the second time.

Mr. T. Kerr Patton exhibited 34 plants from Mesopotamia and 78 from Southern India, collected whilst on service, and mounted on post-cards. He spoke of the soil in Mesopotamia being easily dug with the spade to a depth of thirty feet, and the rapid growth of crops after being sown.

Mr. L. V. Lester-Garland and Mr. C. C. Lacaita contributed further remarks, and Mr. Patton replied.

Mr. C. C. Lacaita showed specimens of *Orchis maculata* collected on Monte Gargano, Italy. Dr. G. C. Druce made some observations, to which Mr. C. C. Lacaita replied.

Dr. G. Claridge Druce exhibited specimens and read the following account:—

"On the Occurrence in Britain as Native Plants of *Ajuga genevensis* and *Centaurium scilloides*, Druce, var. *portense* (Brot.)."

Although there are previous records of *Ajuga genevensis* from Britain the records are probably mistakes for *pyramidalis* or other species, and in one instance due to a garden-escape of the true plant; this discovery of *genevensis* on the Berkshire downs is an undoubted evidence of it as a British species. It was discovered by Miss Fry in May 1918, and the exhibitor went with her in the next week to examine the habitat. Here there seems little likelihood of accidental introduction. The plant grows on the grassy chalk-downs near furze-bushes, but is limited to a small area.

Centaurium scilloides is the *Erythræa diffusa* of Joseph Woods, who discovered it near Morlaix in Brittany. As a somewhat different form it had been previously discovered by Masson in the Azores, where it is said to be always a white-flowered form. The younger Linnæus (Suppl. 175, 1781) described the latter as *Gentiana scilloides* with yellow flowers, a mistake which misled botanists to

think it was a form of the yellow-flowered *maritimum*. Brotero (Fl. Lusit. i. 278, 1804) gave to the mainland form the name of *Gentiana portensis*, so called from Oporto, near which place it occurs.

Since our plant is the pink-flowered plant of the mainland it has been named as above, Brotero's being the earliest trivial name. The plant was sent me in September 1918, when I was away from home, by Mr. Arnett of Tenby. This year I went to visit the locality where the friend of Mr. Arnett discovered it, and was informed it was limited to a piece of ground about two yards square, on a headland near Newport, Pembroke. However, I was glad to see it growing on the edge of a grassy cliff over some considerable area in addition to the small patch first discovered. There it seems undisputably native. The bay beneath is open to gales which I was told bring in some considerable quantity of wreckage, but the plant grows with other native species above the reach of ordinary driftage. The question arises, can the small seeds of plants be conveyed in sea-spume, and may this be the cause of the occurrence of *Frankenia* and *Limonium lychnidifolium* on the Jersey cliffs, and incidentally the cause of other members than this interesting *Centaurium*, of the so-called Atlantic species, being introduced in remote times into the British Isles. The record and description of the Pembroke plant as *Erythræa scilloides* was made by Mr. A. J. Wilmott in Journ. Bot. lvi. 1918, p. 321. As in the case of the *Ajuga*, there is a previous record of this *Centaurium* as a British plant, and that on the high authority of Nyman (Consp. 502). But Nyman blindly followed Grisebach (DC. Prod. ix. p. 59), who simply mis-read "Pr. Morlaix Britt., Woods," to mean Britannia instead of Brittany, where Morlaix is situated and where Joseph Woods found it.

Mr. A. J. Wilmott, Mr. C. E. Salmon, and Mr. E. G. Baker discussed various points, Dr. Druce replying.

[Note received 24th November, 1919.—Specimens in the herbaria of Buddle and of Petiver in the British Museum (Natural History) and of Stonestreet, at Oxford, are not contemporaneous with Thomas Johnson, but probably were collected fifty years later.]

Dr. Druce also showed a few highly finished water-colour drawings of British *Rubi* by Miss Trower.

The last communication was by Prof. R. C. McLean, entitled "Sex and Soma," of which the following is an abstract:—

The Author enlarged upon the recently discovered phase of multinucleosis in the developing soma cell of higher plants. The genetic interest of the phenomenon has not received sufficient consideration, and the present paper was designed to direct attention to the possibilities involved. The Author maintained, in opposition to Arber and Beer, that there is evidence of nuclear

reunions taking place in the multinuclear cells, and he characterized these fusions as modified sexual conjugations consequent upon the long series of vegetable divisions in the lineage of a soma cell, and necessary to avoid the degeneration which experiment shows to be attendant upon prolonged vegetative propagation. The development of the plant body may thus be regarded as embracing two phases of stimulus: first, the normal sex stimulus which initiates the period of maximum cell proliferation, and, secondly, this somatic nuclear union, initiating the period of maximum differentiation. Tissue differentiation, it was suggested, may be associated with some process of segregation subsequent to this nuclear fusion. The separation of sex characters in the development of monœcious organisms was pointed to as evidence of the existence of such segregation during development.

It was finally suggested that germinal modifications as well as somatic segregations may be derived from a mechanism of nuclear fractionization and subsequent partial reunion in somatic cells.

December 11th, 1919.

Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The Minutes of the General Meeting of the 20th November, 1919, were read and confirmed.

The report of the Donations received since the last Meeting was laid before the Fellows, and the thanks of the Society to the several Donors were ordered, a special vote being accorded to Mr. Hugh Findon, F.L.S., for his gift of Kirkman's 'British Bird Book.'

Dr. George Parker Bidder, M.A.(Cantab.), Mr. Arthur Robert Thompson, Lieut. R.A.F., Mr. Stuart Hogg, and Mr. Benaiah Colson Adkin, M.A.(Cantab.), were admitted Fellows.

The following were proposed as Fellows:—Dr. George Kenneth Sutherland, M.A.(Aberd.), Mr. Harry Bertram Harding, Mrs. Elinore Egerton Harde, George Albert Boulenger, LL.D., D.Sc., F.R.S., and Mr. Edmund Gustavus Bloomfield Meade-Waldo.

The Certificate in favour of Dr. James Davidson was read for the second time.

Mr. Narayanan Padmanabha Panikkar, B.A., was elected a Fellow.

The proposed alterations in the Bye-Laws, which had been read from the Chair on the 6th and 20th November, were submitted to the Ballot and carried.

Prof. W. A. Herdman, For.Sec.R.S., F.L.S., read his paper entitled "Notes on the abundance of Marine Animals and a quantitative survey of their occurrence," which was illustrated by lantern-slides.

Prof. Dendy and Sir H. H. Howorth, K.C.I.E. (visitor), contributed further observations, and the Author replied.

Mr. J. Bronté Gatenby, B.A.(Cantab.), B.Sc., read his paper, "The Germ-cells and early Development of *Grantia compressa*," which was communicated by Mr. E. S. Goodrich, F.R.S., Zoological Secretary.

Prof. Dendy reviewed his earlier observations on this sponge, and congratulated Mr. Gatenby on his good fortune in securing individuals in a condition to afford such good results—a somewhat rare condition. Dr. G. P. Bidder continued the discussion by adverting to his own observations and deductions from the appearances presented to his view. Mr. Gatenby replied. Many lantern-slides were employed by all these speakers in elucidation of their remarks.

January 15th, 1920.

Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The Minutes of the General Meeting of the 11th December, 1919, were read and confirmed.

The report of the Donations received since the last Meeting was laid before the Fellows, and the thanks of the Society to the several Donors were ordered, a special vote being accorded to the Institute of Preventive Medicine for its gift of a large number of volumes on Sponges formerly the property of the late Prof. E. A. Minchin, F.R.S., Sec.L.S.

Mr. James Robert Matthews was admitted a Fellow.

The following were proposed as Fellows:—Mr. Pyari Mohan Debbarman, B.Sc., M.R.A.S., and Dr. Otto Vernon Darbishire.

The Certificates in favour of the following were read a second time:—Prof. Sahay Ram Bose, M.A. (Calcutta), Mr. Tribhawan Nath Bhan, Dr. Thomas Robertson Sim, Mr. Frank Henry Taylor, F.E.S., and William Rushton Parker, M.A., M.D. (Cantab.).

James Davidson, D.Sc. (Liverp.), F.E.S., was elected a Fellow.

The President spoke on the foundation of the "Goodenough Fund," and stated that a circular explanatory of its purpose would shortly be issued.

Dr. A. B. Rendle, F.R.S., Sec.L.S., read an appeal for contributions in aid of a fund to purchase Monsieur Jules Cardot's Herbarium of Mosses for the Paris Museum of Natural History. He referred to Monsieur Cardot's misfortunes early in the war, and pointed out that the Herbarium is a valuable one, containing as it does the types of a large number of new species—those described by Cardot jointly with F. Renauld, a large number from India and tropical West Africa, the materials on which are based his 'Mousses de Madagascar,' 'Sphaignes d'Europe,' 'Recherches Anatomiques sur les Leucobryacées,' 'Monographie des Fontinalacées,' 'Diagnoses Préliminaires de Mousses Mexicaines,' etc.

The General Secretary gave a lantern lecture entitled "Methods of Botanic Illustration during Four Centuries"; of which the following is an abstract:—

The Lecturer explained his meaning with regard to the word "Illustration," namely, a representation in printing-ink or some similar medium, capable of identic reproduction in considerable numbers, thus excluding all drawings which need hand-copying, and all purely photographic prints. Colour could hardly be touched upon, as it is not easy to display in the lantern. Thus defined, illustration may be held to consist of three main methods:—

(1) When the design projects from the surface, and the ink is applied only to the elevations;

(2) When the design is cut into the surface, and the ink remains only in the depressions;

(3) When the surface is practically level, the design being reproduced by chemical action as in lithography.

1. Surface design. Wood engraving was the first method employed, the early forms being known as block-books, drawing and legend being printed from the same block. On the introduction of movable type the woodcuts were at first confined to the ornamental part, then to copying the pen-drawings found in some of the old Codices of Dioscorides and similar authors. These drawings were crude: a few are selected from the work entitled 'Herbarius' from the first word of the work; it was printed at Maintz in 1484. These beginnings did not long satisfy the people of the Renaissance; accordingly in 1530 a volume came out with representations of plants, by Otto Brunfels, a German schoolmaster. Recently Dr. A. H. Church has published a sympathetic account of this precursor of botanic illustration, commenting on

his fidelity of draughtsmanship even of defects of the specimens before him. In 1542 the splendid folio of Leonhard Fuchs appeared, with woodcuts which have been deservedly praised for their accuracy and style; he gave the portraits of his three helpers, two draughtsmen and the engraver, at the end of his book. Within the next generation we find Rembert Dodoens, Pierre Pena, with his colleague Mathias de l'Obel, followed by many workers, including Charles de l'Escluse, our own John Gerard, the Valgrisi (Venetian printers), Camerarius, Bock, and John Parkinson, whose large blocks were cut "plank-wise"—that is, down the grain—generally of pear-wood, often supplemented by an under layer of deal. With the advent of Thomas Bewick (1753–1828) wood-engraving entered upon a new phase; this celebrated man employed the white line and the flat black in a most skilful manner. Japanese and French specimens show the latest state of what is almost a lost art.

2. Copper plates. Contemporary with the later herbalists, copper-plate etching made its appearance; the etching was simply printed, none of the usual finesse of the copper-plate printer being used. Colonna, Reneaulme, and Alpini may be instanced as having successfully employed etching, and much later, Dillenius. Dry-point, the use of a needle on the plate to produce a burr, was much employed by Dr. John Hill; this burr rapidly wore away, and accounts for the poor appearance of many of Hill's plates, for the plan of "steeling" is a comparatively recent invention.

Engraving by trained craftsmen followed the use of etching; beautiful work may be seen in Vaillant's folio on the plants growing about Paris, and after Ehret, in the 'Hortus Cliffortianus.' Sole's plates in his 'British Mints' display the most elaborate attempt to show texture and colour, in a black plate. Mezzotint to a small extent was tried by John Martyn.

The second period of copper-plate engraving was largely that of stippling, as used by Redouté, and in our own time by Bornet and Thuret.

3. Lithography depends upon the mutual repulsion of oil and water; a drawing upon a certain kind of limestone, made with greasy ink or chalk, will repel water, and the latter when soaked into the stone will repel ink, printing being an alternation of inking and wetting the stone before applying the paper and subjecting it to pressure.

Ectype, Nature-printing or Bradburytype, and Woodburytype were next considered, and then current processes were discussed.

Zinco, or line process blocks, depend upon the property of bichromate salts in conjunction with gelatine or albumen of causing the compound to become insoluble under the action of light. A negative of a drawing is placed upon a metal plate thus sensitised, and after exposure, the gelatine which has been exposed to light remains hard, but the protected gelatine is washed away. The spaces between the lines are etched away with weak acid,

broad spaces are mechanically "routed," and the plate is mounted on wood nearly type-high. This process is only suited to drawings in line or stipple.

Half-tone is a more delicate process, and can be employed in copying various degrees of shading. At the present time a screen of two sheets of ruled glass, crossed and cemented, is placed in the camera near the sensitive plate; this screen is ruled from about 70 lines to the inch, for newspaper work, to 200 for the highest kind on art paper. The crossing of the two series of lines produces a series of dots, white in the darks, black in the lights, acting as pin-hole lenses.

Photogravure was next described, but its place in botanic illustration is small, owing to its cost.

Collotype is printing from a gelatine film, giving beautiful and graduated results without any perceptible grain.

Specimens of the blocks and of plates resulting from the described processes were shown on the table.

The President having spoken, Mr. A. J. Wilmott referred to the stipple-process and the usage of W. Curtis in printing the outlines of his 'Flora Londinensis' in colour, thus aiding the after application of colour.

The Lecturer, in reply, regretted that the large amount of material which had to be compressed into one lecture instead of several, had caused many of his sections to be omitted; he then instanced Redouté's work in stipple, which was printed in the colours appropriate to each part of the plate, the print being finished by hand-colouring.

February 5th, 1920.

Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The Minutes of the General Meeting of the 15th January, 1920, were read and confirmed.

The report of the Donations received since the last Meeting was laid before the Fellows, and the thanks of the Society to the several Donors were ordered.

Mr. Leonard John Sedgwick was admitted a Fellow.

The President announced the vacancies in the list of Foreign Members, caused by the deaths of Prof. William Gilson Farlow, Prof. Ernst Heinrich Philipp August Haeckel, Prof. Gustaf Magnus Retzius, Prof. Simon Schwendener, and Prof. Hermann von Vöchting.

Mr. William Rickatson Dykes, M.A.(Oxon.), L. ès L.(Paris), was proposed as a Fellow.

The following were elected Fellows :—Prof. Sahay Ram Bose, M.A.(Calcutta), Tribhawan Nath Bhan, Dr. Thomas Robertson Sim, Frank Henry Taylor, F.E.S., and William Rushton Parker, M.A., M.D.(Cantab.).

A paper entitled "On the Existence of Two Fundamentally Different Types of Characters in Organisms" was read by Dr. R. Ruggles Gates, F.L.S., of which the following is an abstract :—

The experimentalist point of view regarding evolution, resulting from the work in mutation and Mendelism, is frankly antagonistic to the views of palæontologists, anatomists, and others who deal with orthogenesis and the inheritance of acquired characters. I wish to show that while these two factors bear entirely different relations to evolutionary changes, both are necessary to account for evolution as it has taken place.

The conclusion is reached that higher organisms exhibit two contrasted types of characters, which differ fundamentally (1) in their manner of origin, (2) in their relation to the structure of the organism, (3) in their relation to such phenomena as recapitulation, adaptation, and inheritance, (4) in their relation to geographic distribution.

To the first category belong cell-characters, which arise as mutations, are represented in every cell of the individual, and are usually inherited as distinct entities. Since they are borne in the nuclei, it is proposed to call them karyogenetic characters. To the second category belong organismal characters, which arise gradually through impact of the environment or through orthogenetic changes, may modify only localized portions of the life-cycle, and may not be incorporated in the germ-plasm from the first. They may imply an increase or, in the gametophytes of plants, a shortening in length of the life-cycle.

The development of organismal characters is to be explained in connection with the principle of recapitulation. Embryonic recapitulation has arisen in connection with the adaptation of the organism to a new set of conditions, and implies the inheritance of acquired characters. Orthogenetic recapitulation, as in the juvenal plumage of birds, implies a change which is germinal in origin but added terminally to the life-cycle.

The antithetic alternation of generations in plants, implying the gradual development of the sporophyte by its intercalation between two gametophyte generations, is the same process as the development of orthogenetic recapitulatory characters. The homologous alternation in certain Algæ has probably arisen through a sudden change which is essentially mutational.

The cell theory of mutations leads to the concept of the species

cell. But there are definite limitations to the cell theory of organic structure, as pointed out by Sedgwick, Whitman, and others. The facts of recapitulation also limit the cell theory, for recapitulatory characters arise as lengthenings or shortenings of the life-cycle, and not through chromatic alterations present in every nucleus.

The usual objections to the biogenetic law are based on (1) dissimilarities in related eggs and embryos, (2) the fact that specific characters often appear very early in the ontogeny. Both these situations are to be expected if mutations occur in organisms which show recapitulation. This affords a definite basis for contrasting (*a*) karyogenetic, nuclear, or mutational characters with (*b*) organismal, recapitulatory, or orthogenetic characters.

The President having opened the discussion, the following speakers engaged in it:—Dr. J. R. Leeson, Prof. E. S. Goodrich, F.R.S., Dr. W. Bateson, F.R.S., Dr. F. A. Bather, F.R.S. (visitor), Dr. G. A. Boulenger, F.R.S. (visitor), Prof. F. E. Weiss, F.R.S. (who suggested the term "cytogenetic" as preferable to "karyogenetic"), Mr. W. B. Brierley, Mr. E. S. Russell, B.Sc. (visitor), and the Author replied.

February 19th, 1920.

Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The Minutes of the General Meeting of the 5th February, 1920, were read and confirmed.

The report of the Donations received since the last Meeting was laid before the Fellows, and the thanks of the Society to the several Donors were ordered.

The President announced from the Chair that intelligence had been received that morning of the death of Prof. Pier' Andrea Saccardo, thus causing another vacancy among the Foreign Members.

The following proposed alterations in certain Bye-Laws were read from the Chair for the first time:—

Chap. II. Sect. 2, for "Three Pounds" substitute "Four Pounds."

Chap. II. Sect. 6, delete "who owe more than two Annual Contributions," and insert in place thereof "whose Annual Contributions are due and owing."

The said sections as altered will run thus, the alterations being shown in italic type:—

> Chap. II. Sect. 2. Every Fellow shall also before he is admitted pay the First Annual Contribution of *Four* Pounds, and he shall pay the like Sum annually in advance on each successive 24th Day of May, so long as he shall continue a Fellow; provided, however, that Fellows elected between the 1st Day of March and the 24th Day of May in any year, shall not be liable for a second Annual Contribution until the 24th Day of May in the year following that in which they were elected.
>
> Chap. II. Sect. 6. In the month of November in each year the Council shall cause to be suspended in the Library of the Society a list of the Fellows *whose Annual Contributions are due and owing*, and notice thereof shall forthwith be forwarded to every Fellow whose name appears in such list. If the contributions due from any Fellow named in the said list shall not have been paid within three months after the first suspension of the list the Council may remove such Fellow from the Society, but notwithstanding such removal the obligation of any Fellow so removed may be put in suit for the recovery of any money due from him to the Society. The Council may remit in whole or in part the contributions due from any Fellow.

Mr. J. S. Huxley, M.A., Fellow of New College, Oxford, and Mr. D. F. Leney exhibited living specimens of sexually mature Axolotls metamorphosed into the Amblystoma form by feeding with thyroid gland, and of Urodele larvæ precociously metamorphosed by treatment with iodine solution.

A discussion followed in which the President, Prof. E. S. Goodrich, F.R.S., Sec.L.S., Mr. E. Boulenger (visitor), Lt.-Col. J. H. Tull Walsh, Dr. W. Bateson, F.R.S., and Dr. J. R. Leeson engaged, Mr. Huxley replying.

Major H. C. Gunton read a paper entitled "Entomological-Meteorological Records of ecological facts in the life of British Lepidoptera," which was communicated by the General Secretary.

The Author believed that interesting facts would be obtained by recording and plotting the results of observations made by a number of entomologists in various localities. The scheme exhibited was derived from his notes from February to December 1919, within a radius of four miles from Gerrard's Cross, Bucks, which includes oak and beech woods, heath, marsh, and cultivated land. Special signs are used to denote the occurrence of species of macro-lepidoptera, on sallow-bloom in the spring, on ivy in the autumn, on sugar, and towards light. Thirty-five species of butterflies and two hundred and forty species of moths are thus

tabulated and correlated with meteorological data. The diagram places many facts before the eye, as the long continuance of certain species, the presence of more than one brood and the like. Sugar hardly appeals when honey-dew is abundant, and artificial light is ineffective during bright moonlight. Other problems, as of immigration, still await solution.

Mr. Stanley Edwards contributed further remarks.

March 4th, 1920.

Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The Minutes of the General Meeting of the 19th February, 1920, were read and confirmed.

The report of the Donations received since the last Meeting was laid before the Fellows, and the thanks of the Society to the several Donors were ordered.

Dr. William Rushton Parker was admitted a Fellow.

Certificates in favour of the following were read for the first time:—Shankar Purushottam Agharkar, M.A., Ph.D., John Wishart, M.D., D.Sc., Ch.B., Mr. Howard Hamp Crane, Mr. Eric Fitch Daglish, Ph.D., Capt. R.F.A., and Mr. Bertram Henry Buxton; with the following for the second time:—Mr. Jacques de Vilmorin, Mr. Arthur Lionel Goodday, Lieut. R.G.A., Geoffrey Douglas Hale Carpenter, B.A., D.M., M.B.E., and Mr. Arthur Stanley Hirst.

The following were nominated as Foreign Members:—Prof. Gaston Bonnier (Paris), Prof. Victor Ferdinand Brotherus (Helsingfors), Prof. Giovanni Battista De Toni (Modena), Prof. Louis Dollo (Brussels), Prof. Paul Marchal (Paris), and Prof. Roland Thaxter (Cambridge, Mass.).

Mr. Ernest William Swanton was proposed as an Associate.

The President read for the second time from the Chair, the proposed alterations in Sections 2 & 6 of Chapter II. of the Bye-Laws.

Mr. T. A. Dymes, by favour of the President and on the ground that he would be unable to be present at the following meeting, read a statement concerning the proposed alterations.

The General Secretary, on behalf of Mr. Gerald W. E. Loder, drew attention to ten out of the first twelve numbers of Curtis's 'Botanical Magazine' in the original blue-grey wrappers, and pointed out the information which is lost when the wrappers are destroyed by the bookbinder.

In the present case, no. 1 belongs to the reprint of 1793; it contains the regulations for the use of the Brompton Botanic Garden, and on the fourth page, the contents of No. 77 of the 'Flora Londinensis' namely, *Scilla autumnalis*, *Hieracium umbellatum*, *Carduus polyacanthus*, *C. tenuiflorus*, *Valeriana officinalis*, and *Primula officinalis*.

The communication brought before the Society was entitled "A Contribution to our knowledge of the Botany of New Caledonia."

The subject of this communication is the collection made by Prof. R. H. Compton in New Caledonia and the Isle of Pines during 1914, with the aid of money grants from the Royal Society, the Percy Sladen Memorial Fund, and the Wort's Travelling Fund of Cambridge University. The specimens collected have been presented to the British Museum, and the greater part have been worked out in the Department of Botany at that institution. Since his return, Mr. Compton has been appointed Professor of Botany in the Cape Town University, and Director of the new botanic gardens at Stellenbosch. The various groups have been elaborated by the following botanists: Ferns and Gymnosperms by Prof. R. H. Compton, Flowering Plants by Mr. E. G. Baker, Mr. Spencer Moore, and Dr. A. B. Rendle, Mosses by Mr. I. Thériot, Hepatics by Prof. J. B. Farmer, Maritime Algæ by Mr. A. Gepp, Freshwater Algæ by Dr. Nellie Carter, Fungi by Miss E. M. Wakefield, Lichens by Miss A. Lorrain Smith, Characeæ by Mr. James Groves, and Mycetozoa by Miss G. Lister.

Dr. Rendle gave a short account of the position and physical characters of the island; and referred to previous work on its flora and its general characters. Important features are the igneous rocks which form a mountain chain of gneiss in the north-east, and the serpentine formation which covers the southern portion and occurs in larger or smaller areas throughout the island. The climate is mesothermic; the rainfall is relatively abundant, but owing to evaporation and the porous nature of the soil, many parts of the country have an arid appearance.

The flora is rich, and the proportion of endemic forms exceptionally high. The relative proportions of the different families of flowering plants in the present collection are very similar to those recently worked out by Mr. Guillaumin for the flora as a whole, the four families which contain the highest number of species being Euphorbiaceæ, Rubiaceæ, Orchidaceæ, and Myrtaceæ in each case. The main affinities of the flora are with Indo-Malaya and South-East Australia, the former represented chiefly

in the forest regions and the latter in the scrub and savannah regions; and a study of it suggests that New Caledonia is a very ancient land mass which has been isolated for a very long period.

Dr. RENDLE also gave a résumé of Mr. Compton's account of the Ferns and Gymnosperms. The latter are of great interest; they number about 27 and are all endemic. Mr. BAKER referred to a number of interesting specimens among the Dicotyledonous flowering plants which included many novelties. Miss LORRAIN SMITH gave an account of the Lichens, which include a new genus and a fair proportion of new species. Miss E. M. WAKEFIELD referred to the Fungi, the geographical distribution of which showed points of interest; and Miss G. LISTER described the small collection of Mycetozoa.

The President, Miss A. L. Smith, Mr. C. C. Lacaita, Mr. H. N. Ridley, Dr. J. C. Willis, and Mr. T. A. Sprague commented on the collections.

March 18th, 1920.

Dr. A. SMITH WOODWARD, F.R.S., President, in the Chair.

The Minutes of the General Meeting of the 4th March, 1920, were read and confirmed.

The report of the Donations received since the last Meeting was laid before the Fellows, and the thanks of the Society to the several Donors were ordered.

Mr. Edward Heron-Allen, F.R.S., Prof. Vernon Herbert Blackman, F.R.S., and Dr. James Davidson were admitted Fellows.

Dr. Otto Rosenheim, F.C.S., and Mr. William Harold Pearsall, M.Sc.(Manch.), were proposed as Fellows.

A Certificate in favour of Professor William Grant Craib, M.A.(Aberd.), was read for the second time.

The following were severally balloted for and elected Fellows:— Mr. Jacques de Vilmorin, Mr. Arthur Lionel Goodday, Lieut. R.G.A., Geoffrey Douglas Hale Carpenter, M.B.E., B.A., D.M., and Mr. Arthur Stanley Hirst.

The proposed alterations in Chap. II. Sections 2 and 6, read from the Chair on the 19th February and 4th March, were again

read by the President, who explained the reasons which had obliged the Council to submit these alterations to a ballot by the Fellows, and invited discussion.

Prof. Weiss, F.R.S., commented on the proposed changes, and suggested a reference to the Council, which was at a later stage embodied as a motion; he was followed by the Treasurer (who emphasized the need of a strengthening of the powers of the Council in the matter of Fellows in arrear), Mr. J. C. Shenstone, and Dr. A. B. Rendle, F.R.S., Sec. L.S.

The Fellows present then proceeded to ballot, and the votes having been counted, the President declared that both proposed alterations had been approved by the Fellows; as regards Sect. 2, by 37 in favour and 6 against, 49 Fellows being present, and that Sect. 6 had been approved by 37 in favour with 3 against, in each case by a two-thirds majority of Fellows present. The alterations were thereupon declared by the President as passed by the Fellows.

Prof. Weiss thereupon moved:—"That the Council be asked to consider the question of a reduction of payment in the case of Fellows who do not desire to take the publications," which being seconded by Miss M. Carson, was put to the vote by show of hands, and carried.

Prof. James Small, D.Sc., F.L.S., then gave a lantern demonstration of "The Chemical Reversal of Geotropic Response in Roots and Stems." (Printed as a paper in 'The New Phytologist,' xix. nos. 3 & 4, 1920.)

In the discussion which followed, Prof. Weiss, F.R.S., Capt. A. W. Hill, Prof. V. H. Blackman, F.R.S., and Prof. E. S. Goodrich, F.R.S., Sec.L.S., took part.

April 15th, 1920.

Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The Minutes of the General Meeting of the 18th March, 1920, were read and confirmed.

The report of the Donations received since the last Meeting was laid before the Fellows, and the thanks of the Society to the several Donors were ordered.

The following were proposed as Fellows:—Mr. Raymond Alfred Finlayson, and Mr. Tom Russell Goddard.

Certificates in favour of the following were read for the second time:—Mr. Sydney Percy-Lancaster, Mr. Herbert William

Pugsley, B.A.(Lond.), Mr. Joseph Omer-Cooper, Miss Lucy Ellen Cox, B.Sc.(Lond.), George Kenneth Sutherland, M.A., D.Sc. (Aberd.), Mr. Harry Bertram Harding, and Mrs. Herbert Spencer Harde (Elinore Egerton Harde).

Professor William Grant Craib, M.A.(Aberd.), was elected a Fellow, and Mr. Ernest William Swanton, an Associate.

The President read the following Resolution which had been referred to the General Meeting for discussion and adoption :—

> This Meeting of the Linnean Society views with alarm and indignation the proposal to introduce a private Bill into Parliament with the object of securing the enclosure of portions of Wanstead Flats and Epping Forest for permanent allotments and calls upon the Government to oppose this attempt to nullify the provisions of the Epping Forest Act of 1878, which requires the Forest to be preserved "unenclosed . . . as an open space for the recreation and enjoyment of the public" for ever.

Mr. R. Paulson, President of the Essex Field Club, explained the reason for this appeal, and the discussion was continued by the Rev. Canon Bullock-Webster, Mr. H. R. Darlington, Mr. Lester-Garland, Lt.-Col. J. H. Tull Walsh, Mr. Stanley Edwards, Dr. A. B. Rendle, and Dr. W. R. Parker.

Upon a vote being taken it was decided to postpone action until more definite information could be obtained of the proposed Bill.

Capt. F. Kingdon Ward, B.A., F.R.G.S., gave an account of his "Natural History Exploration on the North-East Frontier of Burma," which was illustrated by a series of lantern-slides.

Mr. H. N. Ridley, Dr. O. Stapf, and the President contributed additional remarks, and the Lecturer replied.

Mr. R. Paulson, F.L.S., showed lantern-slides illustrating definite stages in the Sporulation of Gonidia within the thallus of the lichen *Evernia Prunastri*, Ach.

Captain J. Ramsbottom spoke in support of the views put forward by the author.

May 6th, 1920.

Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The Minutes of the General Meeting of the 15th April, 1920, were read and confirmed.

The report of the Donations received since the last Meeting was laid before the Fellows, and the thanks of the Society to the several Donors were ordered.

Mr. Arthur Lionel Goodday was admitted a Fellow.

Mr. William Henry Kitching, Mr. Chintaman Mahader Tembé, Mr. Rowland Maurice Richards, Louis, Vicomte de Sibour, F.Z.S., Mr. Rustom Hormasji Dastur, B.Sc. (Bombay), and Mr. John William Bodger, were proposed as Fellows.

Certificates in favour of the following were read for the second time:—Mr. Edmund Gustavus Bloomfield Meade-Waldo, Mr. Pyari Mohan Debbarman, B.Sc., Prof. Otto Vernon Darbishire, B.A., Ph.D., Mr. William Rickatson Dykes, M.A. (Oxon.), L.ès L. (Paris), Prof. Shankar Purushottam Agharkar, M.A., Ph.D., Dr. John Wishart, Howard Hamp Crane, Capt. Eric Fitch Daglish, Ph.D., Mr. Bertram Henry Buxton, and Prof. Otto Rosenheim, Ph.D., F.C.S.

The following were balloted for and elected:—*Fellows*: Mr. Sydney Percy-Lancaster, F.R.H.S., Herbert William Pugsley, B.A. (Lond.), Mr. Joseph Omer-Cooper, Miss Lucy Ellen Cox, B.Sc. (Lond.), Dr. George Kenneth Sutherland, M.A., Mr. Harry Bertram Harding, F.R.M.S., and Mrs. Elinore Egerton Harde; *Foreign Members*: Prof. Gaston Bonnier, Prof. Victor Ferdinand Brotherus, Prof. Giovanni Battista de Toni, Prof. Louis Dollo, Prof. Paul Marchal, and Prof. Roland Thaxter, Ph.D.

The President remarked upon the recent issue of two new volumes of the Ray Society, which were shown on the table, namely, 'British Orthoptera,' by Mr. Lucas, and the first volume of the 'British Charophyta,' by Mr. Groves and Canon Bullock-Webster.

The following Auditors were proposed, and elected by show of hands:—For the Council: Mr. E. T. Browne, Mr. Stanley Edwards; for the Fellows: Mr. T. A. Dymes, Mr. R. Paulson.

Dr. G. P. Bidder, F.L.S., read three communications on Sponges, entitled:—(1) "The Fragrance of Calcinean Sponges," (2) "*Syncrypta spongiarum*," and (3) "Notes on the Physiology of Sponges."

The discussion which followed was maintained by Prof. Dendy, Mr. Harold Russell, and Mr. J. B. Gatenby (visitor), the Author replying.

Mr. Edward J. Bedford showed a series of thirty exquisite water-colour drawings of British Marsh and Spotted Orchids, with their numerous varieties and hybrids, further illustrated by 70 lantern-slides from his photographs of the growing plants *in situ*, and enlarged views of the lip, front and side views (See p. 65.)

Mr. H. W. Pugsley and Mr. T. A. Dymes contributed further remarks: the latter exhibited a series of fruit capsules, and remarked on the characters afforded by these variable plants in their fruits and seeds; Mr. Bedford briefly replying.

May 27th, 1920.

Anniversary Meeting.

Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The Minutes of the General Meeting of the 6th May, 1920, were read and confirmed.

The report of the Donations received since the last Meeting was laid before the Fellows, and the thanks of the Society to the several Donors were ordered.

Dr. Vedāranyeśnara Vaidyanātha Ramana-Śāstrin, and Lieut.-Col. Anthony Hurt Wolley-Dod, R.A., were proposed as Fellows.

The number of Fellows was reported to be 700, with 10 for ballot at the next ensuing General Meeting.

The Treasurer made his Annual Report on the Accounts of the Society, and the Statement (see pp. 22–24), duly audited, was received and adopted.

Dr. J. R. Leeson drew attention to the great need of a new Catalogue of the Library.

The General Secretary stated that the MS. was practically ready for printing, and in reply to further questions, said that the edition of 1896 was out of print, the whole of the 1000 copies printed having been sold.

The General Secretary reported that since the last Anniversary the following had died or their deaths been ascertained, namely: -

16 Fellows.

Lt.-Col. Linley Blathwayt.
Henry G. Flanagan.
Ernest Gibson.
Frank Hicks.
John Hopkinson.
Henry Owen Huskisson.
Valavanur Subramania Iyer.
Rev. Edward Shearburn Marshall.
The Rt. Hon. Alexander Peckover, Baron Peckover of Wisbech.
Sir Peter Wyatt Squire.
Henry Charles Stephens.
Prof. James William Helenus Trail.
John Sidney Turner.
William James Tutcher.
Prof. George Stephen West.
Alfred Prentice Young.

8 Foreign Members.

William Gilson Farlow.
Ernst Heinrich Haeckel.
Wilhelm Pfeffer.
Magnus Gustaf Retzius.
Pier' Andrea Saccardo.
Simon Schwendener.
Franz Steindachner.
Hermann von Vochting.

That the following 19 Fellows had withdrawn :—

Oliver Vernon Aplin.
Robert William Ascroft.
Bernard Francis Cavanagh.
Catherine, Lady Crisp.
Hamilton Herbert Charles James Druce.
Rev. Robert Gardner-Smith.
Arthur Woldemar Geffcken.
William Henry Johnson.
Alfred Ernest Knight.
Benjamin Thompson Lowne.
Gregory Macalister Mathews.
Albert Davidson Michael.
Albert Charles Frederick Morgan.
Miss Winifred Smith.
George Brettingham Sowerby.
Mrs. Mary Newman Tremearne.
James Walter White.
John Charles Wilson.
William Wise.

And that the Council had removed the following from the List, in accordance with the Bye-Laws, Chap. II. Sect. 6 :—

Alfred Eastham.
James Thomas Hamilton.
Joseph Crosby Smith.

During the same period 40 Fellows have been elected, of whom 33 have qualified up to the present. Also 6 Foreign Members and 1 Associate have been elected.

The Librarian's report was read, showing that donations from private individuals and editors amounted to 40 volumes and 232 pamphlets and parts, by exchange 153 volumes and 375 detached parts, by purchase 50 volumes and 263 parts ; in all, the accessions amounted to 243 volumes and 870 pamphlets and separate parts.

Books bound amounted to 564: 28 in half-morocco, 29 in buckram, 133 in half-buckram, 89 in cloth, with 285 rebacked.

The General Secretary having read the Bye-laws governing the Elections, the President opened the business of the day, and the Fellows present proceeded to ballot.

The Ballot for the Council having been closed, the President appointed Prof. Weiss, Mr. T. A. Dymes, and Mr. W. S. Rowntree Scrutineers; and these, having examined the ballot-papers and cast up the votes, reported to the President, who declared the Council to be as follows :—

Edmund G. Baker, Esq. ; Prof. Margaret Benson, D.Sc. ; E. T. Browne, M.A. ; *Henry Bury, M.A. ; Stanley Edwards, F.Z.S. ; Prof. J. B. Farmer, F.R.S. ; Prof. E. S. Goodrich, F.R.S. ; *Capt. A. W. Hill, M.A., D.Sc. ; Dr. B. Daydon Jackson ; C. C. Lacaita, M.A. ; Gerald W. E. Loder, M.A. ; Horace W. Monckton, F.G.S. ; R. I. Pocock, F.R.S. ; Dr. A. B. Rendle, F.R.S. ; *The Rt. Hon. Lionel Walter, Baron Rothschild, F.R.S. ; *Dr. E. J. Salisbury ; *Charles Edgar Salmon, Esq. ; Miss A. Lorrain Smith ; Lt.-Col. J. H. Tull Walsh ; Dr. A. Smith Woodward, F.R.S.

(New members are shown by an asterisk. The retiring Councillors were: Dr. W. Bateson; R. H. Burne, Esq.; Dr. D. H. Scott; A. W. Sutton, Esq.; and Dr. Harold Wager.)

The Ballot for the Officers having been closed, the President appointed the same Scrutineers; and these, having examined the Ballot-papers and cast up the votes, reported to the President, who declared the result as follows:—

President: Dr. Arthur Smith Woodward, F.R.S.

Treasurer: Horace W. Monckton, F.G.S.

Secretaries: Dr. B. Daydon Jackson.
Prof. E. S. Goodrich, F.R.S.
Dr. A. B. Rendle, F.R.S.

The President then delivered an Address, on certain groups of fossil Fishes, illustrated by a series of lantern-slides (see p. 25).

Treasurer's Accounts for the Year ended April 30th, 1920.

(Presented at the Anniversary Meeting, May 27th, 1920.)

Receipts and Payments of the Linnean Society from May 1st, 1919, to April 30th, 1920.

General Account.

Receipts.	£	s.	d.
Balance at Bankers on 1st May, 1919	444	13	7
Cash in hand	2	1	4
Interest on Investments	308	5	11
Admission Fees	192	0	0
Annual Contributions	1668	0	0
Compositions	179	0	0
Sales of Publications :—			
Transactions £23 5 4			
Journals 125 15 4			
Proceedings and Catalogues 8 8 3			
	157	8	11
Fellows' postal account, deposits	16	16	3
Donations in aid of Publications	66	0	0
Miscellaneous Receipts	8	2	6
	£3042	8	6

Payments.	£	s.	d.
Taxes and Insurance	24	9	3
Repairs and Furniture	84	15	9
Coal, Electric Current, and Gas	94	19	2
Salaries	907	19	9
Library :—			
Books (New Books £22 18 0) £107 11 1			
Binding 176 7 11			
	283	19	0
Expenses of Publications :—			
Printing £788 7 0			
Illustrations 156 10 7			
Distribution 56 19 9			
	1001	17	4
Miscellaneous Printing and Stationery	228	13	4
Petty Expenses (including Tea and Postage) £115 3 5			
Fellows' postal account 6 18 1			
	122	1	6
Investments £126 15 2 5% War Loan, 1929–47	119	18	2
Linnean Medal	15	5	0
Balance at Bankers, 30th April, 1920 (including £101 11 0, deposits, Fellows' postal account) £152 0 4			
Cash in hand 6 9 11			
	158	10	3
	£3042	8	6

Separate Account.

		£	s.	d.
To Balance at Bankers, 1st May, 1919 :—				
Westwood Fund	£4 9 1			
Trail Award Fund	15 16 0			
Crisp Award Fund	14 3 4			
Hooker Lecture Fund	2 9 4			
Tagart Fund	17 6 4			
		54	4	1
„ Donations :—				
Goodenough Fund	£83 19 6			
Library Catalogue Fund	1 1 0			
		85	0	6
„ Interest on Investments :—				
Westwood Fund	£8 5 6			
Trail Award Fund	3 10 0			
Crisp Award Fund	6 6 4			
Hooker Lecture Fund	20 11 2			
Tagart Fund	14 5 10			
Goodenough Fund	17 11			
		53	16	9
		£193	1	4

		£	s.	d.
By Binding of Books (Tagart Fund)			16	6
„ Cost of conversion of £100 National War Bonds into £150 4 % Victory Bonds :—				
Westwood Fund	£12 10 0			
Hooker Lecture Fund	2 9 11			
Tagart Fund	12 10 1			
		27	10	0
„ Purchase of £50 Victory Bonds 4 % :—				
Goodenough Fund		42	0	6
„ Balance at Bankers, 30th April, 1920 :—				
Westwood Fund	£ 4 7			
Trail Award Fund	19 6 0			
Crisp Award Fund	20 9 8			
Hooker Lecture Fund	20 10 7			
Tagart Fund	18 5 7			
Goodenough Fund	42 16 11			
Library Catalogue Fund	1 1 0			
		122	14	4
		£193	1	4

Investments on April 30th, 1920.

General Account.

£	s.	d.			*Value, 30th April, 1920.* £	s.	d.
450	0	0	Forth Bridge Railway 4 per cent. Stock	@ $62\frac{1}{2}$	281	5	0
1000	0	0	Metropolitan Consolidated 3 per cent. Stock	@ 60	600	0	0
1200	0	0	India 3 per cent. Stock	@ 48	576	0	0
1000	0	0	Eastern Bengal Railway 4 per cent. Debenture Stock	@ $62\frac{1}{2}$	625	0	0
1000	0	0	Great Western Railway 4 per cent. Debenture Stock	@ 67	670	0	0
300	0	0	Midland Railway $2\frac{1}{2}$ per cent. Perpetual Preference Stock	@ 39	117	0	0
3200	0	0	5 per cent. War Loan, 1929–47 Inscribed (including £315 15*s.* 9*d.* resulting from conversion of £300 National War Bonds in last year's Accounts)	@ $83\frac{3}{4}$	2680	0	0
					£5549	5	0

Separate Account: Investments on April 30th, 1920.

£	s.	d.			£	s.	d.
£870 9 5	232	5	0	Metropolitan Water Board 3 per cent. "B" Stock (Westwood Fund)	@ 49	113	16	0
	638	4	5	Ditto ditto (Hooker Lecture Fund)	@ 49	312	14	7
	100	0	0	New South Wales 3½ per cent. Stock, 1930-50 (Trail Award Fund)	@ 60½	60	10	0
	252	18	0	2½ per cent. Consolidated Stock (Crisp Award Fund)	@ 47	118	17	3
	530	0	0	East India Railway 3½ per cent. Debenture Stock (Tagart Fund)	@ 54½	288	17	0
£200 0 0	50	0	0	4 per cent. Victory Bonds (including £118 resulting from conversion of £100 National War Bonds in last year's accounts). (Westwood Fund)	@ 77½	155	0	0
	50	0	0	(Tagart Fund).....				
	50	0	0	(Hooker Lecture Fund)				
	50	0	0	(Goodenough Fund) ...				
						£1049	14	10

HORACE W. MONCKTON, *Treasurer.*

We have (in conjunction with the Professional Auditor, who certifies as to all details) audited the Accounts of the Society for the year ended 30th April, 1920, and found them correct. We have verified the Investments and Bank Balances.

Dated this 13th May, 1920.

W. B. KEEN, *Chartered Accountant.*

A. SMITH WOODWARD,
ROBERT PAULSON,
STANLEY EDWARDS,
T. A. DYMES,
EDWARD T. BROWNE,
B. DAYDON JACKSON,
} *Auditors.*

PRESIDENTIAL ADDRESS, 1920.

During his various travels, especially in Oeland, Gothland, and Scania, Linnæus became much interested in the petrified remains of animals and plants which he and his students collected from the stratified rocks. He made careful observations on their mode of occurrence, compared his results with those already published by naturalists in other countries, and eventually, in the 12th edition of his 'Systema Naturæ,' devoted an important section to the arrangement and interpretation of the numerous "petrifactions" by that time known. He quoted with approval the Italian Ramazzini's remark that the layers of rock should be considered as representing a succession of ages rather than as "the tumultuous jumble of the general deluge." In the quaint words of Dr. William Turton's translation, he concluded:—"The intelligent investigator will not therefore straiten the limits of an useful science, by disregarding the ancient inhabitants of the globe, though unknown to modern naturalists."

Since this wise and far-seeing observation of Linnæus in 1768, "the ancient inhabitants of the globe" have indeed been much "regarded," and it has become increasingly clear that they must always be taken into account when the wider problems of life are being considered. Not long after the foundation of the Linnean Society towards the end of the eighteenth century, the succession of extinct animals and plants was sufficiently understood to show that there had been a gradual progression of life on the earth from the lowest to the highest, and that the existing world was only the consummation. When the details of the extinct forms were studied, the differences between the past and the present appeared to be even more marked. Still later, especially after the work of Darwin, when explorations and collections multiplied, many definite progressive and retrogressive series of animals were recognised as they were traced through geological time. Eventually, during more recent years, curious parallel developments have been noticed in many groups of different classes, which suggest that certain changes are inevitable and are the successive marks of immaturity, dominance, and old age in each race. It is, in fact, difficult to be sure of the real meaning of the characters and distribution of any group of organisms as it exists to-day without some knowledge of its ancestry in the past.

Unfortunately, in most cases, this ancestry is unattainable; for organic remains are only preserved in rocks by accident, and animals at any rate are rarely represented by more than their skeletons. The vast majority of the most interesting generalised types of past ages must have lacked hard parts which could be fossilised; and even those which are represented by skeletons are not easily interpreted unless they happen to have close allies among existing life.

As an illustration of the difficulties and limitations in the study of extinct animals, I would refer to the earliest geological evidence of the Vertebrata which I have long had the opportunity of investigating. The oldest fossils which are comparable with vertebrate skeletons can scarcely belong to animals lower in grade than the existing Cyclostomes, and they are all either too vaguely shown or too highly specialised to give any satisfactory clue to the invertebrate group from which they were descended. In outward shape many of the armoured forms much resemble the contemporary Merostomata and the later marine Arachnids, but to recognize any genetic connection, such as is advocated by Gaskell* and Patten†, involves more assumptions than are justifiable. The most generalised forms found as fossils are all distinctively fish-shaped, and there can be no doubt that the really annectant types which preceded them were soft-bodied and not likely to be preserved.

These earliest vertebrates occur abundantly in some of the uppermost Silurian deposits of western and northern Europe, but most of them have so slight a skeleton that they appear as mere stains on the surface of the rock. Interesting though tantalising new specimens have lately been collected by Mr. William McPherson for the British Museum from the Downtonian shales of Ayrshire. Even those genera in which the skin is provided with well-calcified shagreen or scales show very little beyond their general contour. Fortunately, however, they are followed in the overlying Devonian formations both of Europe and North America, and even of the southern hemisphere, by numerous more specialised members of the same group, in which many of the dermal tubercles have coalesced with a deeper-seated calcification into symmetrically-arranged plates, which often bear marks of subjacent internal organs. It is thus possible to make some attempt at their interpretation.

Some have doubted whether all these primitive organisms belong to a single group, but I still think Cope was probably right when he included all those known to him in his subclass Ostracodermi (or Ostracophori). The genera without armour-plates discovered in more recent years seem to pass by gradations into the others, and therefore presumably had the same fundamental characters. The anterior visceral arches are not modified into ordinary jaws—at least, if they were so, we should expect to find them either calcified or covered with a corresponding exoskeleton. The gill-arches, in an extensive gill-chamber, are far forwards. There are no paired fins; while in the median fins there are no ordinary fin-rays, but rows of scales instead. The dermal plates, when present, are highly vascular, and they always retain as a superficial layer the tubercles of dentine which are the sole covering of the more generalised forms.

* W. H. Gaskell, 'The Origin of Vertebrates' (London, 1908).

† W. Patten, 'The Evolution of the Vertebrates and their Kin' (Philadelphia, 1912).

Anaspida.

The most isolated and least-known order of the Ostracoderms is that of the Anaspida, which are either fusiform free-swimmers or elongated and almost eel-shaped. They are usually only from 10 to 15 cm. in length, and with one exception they are known only from the Downtonian Passage Beds at the top of the Silurian System. They are probably to be regarded as the latest survivors of the ancestral Ostracoderms, which were beginning to acquire a hard dermal skeleton at the end of Silurian times.

The Anaspida were first described from Ayrshire and Lanarkshire by Traquair *, who recognised two genera, *Birkenia* and *Lasanius*. *Birkenia* is completely covered with scales, which are fusiform and rather irregularly arranged on the head, but deep and narrow and disposed in oblique lines inclined forwards and downwards on the trunk. A single row of enlarged scutes extends along the lower border of the trunk; and small scales take the place of fin-rays on the single dorsal fin and on the lower lobe of the distinctly heterocercal tail. Low on the side of the head there is the orbit, surrounded by large plates resembling the circumorbital plates of the Acanthodian fishes; behind the head an oblique line of pores may be interpreted as gill-openings; while a double scute at about the middle of the ventral series probably marks the cloaca. Otherwise, there are no indications of the internal parts of the animal. *Lasanius* occurs as a mere stain on the rock, bounded below by the single series of ventral scutes, and partially armoured only in the foremost part of the trunk by a few oblique rows of scales, which are fused into rods showing a triangular expansion only at the point where they are crossed by the lateral line. The forked heterocercal tail is distinct, but I have never seen any ordinary fin-rays in its lower lobe. The eye is marked by a dark stain; and slight dermal calcifications seem to indicate the position of the row of supposed branchial openings corresponding with those of *Birkenia*.

A fragment, either of *Birkenia* or of a related genus, has been found in rocks of the same age in New Brunswick, Canada †, and three other Anaspida are now known from the Downtonian formation of southern Norway ‡. The latter have not yet been fully described, but one of them (*Pterolepis nitidus*) is specially interesting because its dorsal fin is armed with an anterior spine. Detached fin-spines (*Onchus*) of Silurian age have generally been regarded as referable to Elasmobranch fishes, but this new discovery shows that they may belong to vertebrates of much lower grade.

* R. H. Traquair, Trans. Roy. Soc. Edinb. vol. xxxix. (1899), pp. 837-843, pl. 5; also *loc. cit.* vol. xl. (1905), pp. 886–7, pl. 2. figs. 4–8.

† *Ctenoplewron nerepisense*, G. F. Matthew, Trans. Roy. Soc. Canada, ser. 3, vol. i. (1907), sect. 4, p. 7, pl. 1.

‡ J. Kiær, Skrift. Vidensk.-Selsk. Kristiania, Mat.-naturv. Kl. 1911, no. 7, pp. 17–19.

That some Anaspida survived unchanged until the end of Devonian times seems to be proved by *Euphanerops longævus* from the Upper Devonian of Canada *. They must, however, have been very rare or local, for hitherto they are known only by one specimen of the species just mentioned.

Heterostraci.

The next order of Ostracoderms comprises families adapted for life mainly at the bottom of the shores, estuaries, or lakes in which they dwelt. They have a relatively large depressed head, and a small mobile tail ending in a heterocercal fin. Most of them are larger than the Anaspida, and they range upwards through the Devonian formations, increasing in size until in the Upper Devonian some of them (*Psammosteus*) are more than half a metre in length †. These are the largest Ostracoderms known.

Fig. 1.

Restoration of *Thelodus scoticus*, from the Downtonian Passage Beds of Lanarkshire, about one-half nat. size. The head shown from above, the tail twisted to be seen mainly in side-view. (After Traquair.)

The most abundant early members of the order in the Downtonian Passage Beds and the Upper Silurian are protected only by a nearly uniform covering of shagreen closely similar to that of sharks. When the isolated dermal tubercles of *Thelodus* were first discovered, indeed, they were regarded as belonging to Elasmobranch fishes; but it is now clear that this simplest type of vertebrate armature was also assumed by primitive fish-like organisms which show no other real resemblance to Elasmobranchs. As described by Traquair ‡, *Thelodus* (fig. 1) and *Lanarkia*, when crushed in their fossilised state, exhibit a broad head-region, rounded in front and truncated at the hinder border, from the middle of which the comparatively slender body-region

* A. S. Woodward, Ann. & Mag. Nat. Hist. [7] vol. v. (1900), p. 416, pl. 10. fig. 1.

† A. S. Woodward, Ann. & Mag. Nat. Hist. [8] vol. viii. (1911), p. 649, pl. 9. For micro. structure see J. Kiær, Rep. 2nd Norweg. Exped. 'Fram' 1898–1902, no. 33 (1915), pp. 24, 28, 35, pl. 3. figs. 3, 4, pl. 6, text-figs. 5, 8.

‡ R. H. Traquair, Trans. Roy. Soc. Edinb. vol. xxxix. (1899), pp. 829–834, pls. 1–4; and *loc. cit.* vol. xl. (1905), pp. 880–883, text-figs. 1, 2.

is continued; the head being doubtless seen from above or below, while the body is usually twisted and displayed in side-view. The only traces of internal organs observed by Traquair were stains marking the position of the lateral eyes, paired parallel bars suggesting branchial arches, and (in a single specimen of *Lanarkia* *) curious square spaces near the lateral border of the head apparently corresponding with the vacuities in the head-shield of *Eukeraspis* which I regard as being in the roof of the branchial chambers. In addition, I have observed in the lower lobe of the caudal fin of *Thelodus* undoubted indications of the stout cartilaginous hæmal spines of the vertebral axis.

Through *Kallostracon* and *Tolypelepis* or *Tolypaspis* †, the primitive Heterostraci just described seem to pass into *Cyathaspis*, *Palæaspis*, and *Pteraspis* ‡, in which the shagreen-granules on the head are united into a few symmetrically-arranged plates by fusion with underlying calcified tissue. The shape and arrangement of these plates were probably determined by the disposition of the sensory canals which traverse them. Their superficial tubercles are fused into more or less concentric ridges; their middle layer is coarsely chambered for vascular spaces; their basal layer is usually laminated. In no part of the armour are there any bone-cells. The orbits are distinct at the sides of the base of the rostrum, and a pair of larger openings in the dorso-lateral plates near the hinder end of the shield are probably the outlets of the branchial chambers. The inner or visceral face of the large median dorsal plate, especially in *Cyathaspis* §, shows a small median pit just behind the position of the orbits evidently for the reception of a pineal body. Further back are a pair of >-shaped markings which may be due to the semicircular canals of the otic capsules. Near each lateral margin is a row of pittings which are probably the impressions of branchial pouches. One ventral shield of *Cyathaspis*, described by Leriche ‖, also bears corresponding impressions of the supposed branchial pouches. The body behind the shield is imperfectly known, but in *Pteraspis* it is scaly, and there can be no doubt that the body-cavity extended into it with the cloacal opening far back.

The Pteraspidians thus described, showing marks of internal soft parts, do not range upwards above the Lower Devonian. As they become fewer they are gradually replaced by another group

* R. H. Traquair, *loc. cit.* vol. xl. (1905), p. 882, pl. 2. figs. 2, 3.

† J. V. Rohon, Mém. Acad. Imp. Sci. St.-Pétersbourg [7], vol. xli. no. 5 (1893), p. 76, pl. 1. figs. 42, 45, 47, and pl. 2. figs. 54, 56.

‡ E. Ray Lankester, in Powrie & Lankester, 'A Monograph of the Fishes of the Old Red Sandstone of Britain,' pt. i. (Palæont. Soc. 1868); also Geol. Mag. vol. x. (1873), p. 241, pl. 10. A. S. Woodward, 'Catalogue of the Fossil Fishes in the British Museum,' pt. ii. (1891), pp. 159–176, with figs. G. Lindström, Bihang K. Svensk. Vet.-Akad. Handl. vol. xxi. (1895), sect. iv. no. 3, with 2 pls. (*Cyathaspis*).

§ A. S. Woodward, *op. cit.* 1891, p. 172, pl. 9. fig. 4.

‖ M. Leriche, Mém. Soc. Géol. Nord, vol. v. no. 1 (1906), p. 25, pl. 1. fig. 5 text-fig. 7.

of Heterostraci, represented by larger species, which are also armoured with plates and scales, but show little or no trace of the underlying soft parts. *Drepanaspis* (fig. 2), from the Lower Devonian of Gmünden, Eifel, is the best known genus, and several specimens have been found with nearly all the dermal plates in their natural position. It is a much depressed, almost skate-shaped fish, with a very short rostrum and the orbits piercing a pair of small antero-lateral plates which are directed both laterally and upwards. As in the Pteraspidians, the greater part

Fig. 2.

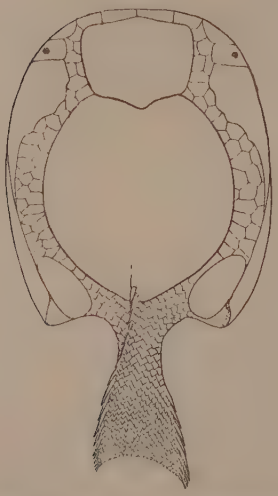


Fig. 3.

Fig. 2.—Restoration of *Drepanaspis gemuendenensis*, dorsal aspect, from the Lower Devonian of Gmünden, Eifel, about one-quarter nat. size.

Fig. 3.—Drawing of nearly complete fossil of *Phyllolepis concentrica*, dorsal aspect, from the Upper Old Red Sandstone, Dura Den, Fifeshire, about one-third nat. size. The lines radiating from the centre of the anterior median dorsal plate probably represent sensory canals. British Museum, no. P. 11912.

of the back is covered by two median plates, of which the hinder is the larger and cleft behind for the insertion of a small spine. Smaller plates surround these in front as well as at the sides, and the hindmost laterals seem to enclose a pair of branchial openings. Again, as in the Pteraspidians, the greater part of the ventral surface is covered by one large median plate, and in front of this a number of small plates surround the mouth in an undetermined manner. The small scaly tail is laterally compressed, and the large fulcral scales on its dorsal border form a close series

beginning immediately behind the dorsal spine already mentioned, while the corresponding ventral series of fulcral scales stops at a short distance from the hinder border of the median ventral plate, leaving a gap doubtless for the cloacal opening.

When Traquair * first interpreted *Drepanaspis* he reversed the dorsal and ventral aspects as just described, because he observed that the stronger and longer lobe of the tail was apparently on the same aspect as the single median plate, while the cleft in the hinder of the two opposing median plates might be regarded as the cloacal opening. The interpretation of Dean † and Kiær ‡, however, now adopted, seems to be confirmed by the recent discovery of a nearly complete specimen of *Phyllolepis* (fig. 3) §, which is evidently an Upper Devonian representative of the same group. Here the dorsal aspect is undoubtedly that on which the two median plates occur, and the ventral aspect bears only one large plate (perhaps paired) with an extensive gap in front for the mouth-parts. In front and round part of the sides of the median dorsal plates there is a single row of marginal plates, ending behind in a pair of backwardly-directed cornua; but the orbits do not pierce any of these plates, and their exact position, though evidently lateral, is uncertain. The small tail is scaleless, and in the fossil it shows remains of the superficially calcified neural and hæmal arches of the notochordal axis.

Osteostraci.

Another order of Ostracoderms with a large depressed head is armoured in this region with small polygonal plates, which are variously fused together. Bone-cells are conspicuous in all the hard tissue except the superficial layer of tubercles. The eyes are close together in the middle of the top of the head. The tail, as a rule, is relatively larger than that of the Heterostraci, ending in the usual heterocercal fin; and it is covered with scales, which are more or less deepened on the flank. The Osteostraci range from the Upper Silurian to the Upper Devonian, but are very rare above the Lower Devonian.

The armour of the typical widely-ranging genus *Cephalaspis* (fig. 4) ‖ bears several indications of the underlying soft parts. The little plate between the orbits is marked by a pit, evidently for the pineal body; and in front of it there are other markings

* R. H. Traquair, Trans. Roy. Soc. Edinb. vol. xxxix. (1899), p. 844, text-fig. 5; *loc. cit.* vol. xl. (1903), p. 725, pl. 1. figs. 1–3, pls. 2–4, text-figs. 1–3; *loc. cit.* vol. xli. (1905), p. 469, pls. 1–3; Geol. Mag. [4] vol. vii. (1900), p. 153, figs. 1–3; *loc. cit.* vol. ix. (1902), p. 289, figs. 1, 2.

† B. Dean, Science, n. s. vol. xix. (1904), p. 64.

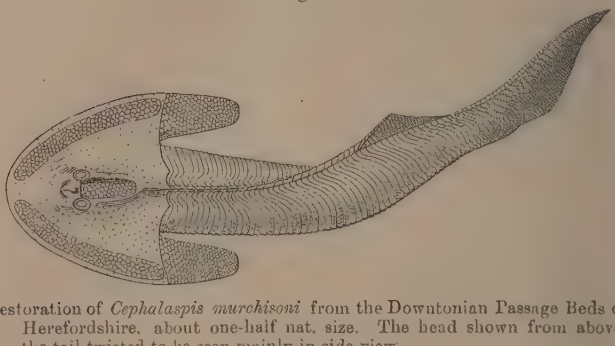
‡ J. Kiær, Rep. 2nd Norweg. Arctic Exped. 'Fram' 1898–1902, no. 33 (1915), pp. 29, 33, pl. 3. figs. 5, 6, pl. 4. fig. 2, text-figs. 6, 7.

§ A. S. Woodward, Rep. Brit. Assoc. (Australia, 1914), 1915, p. 122, pl. 2.

‖ See especially E. Ray Lankester in Powrie & Lankester, 'Fishes of the Old Red Sandstone,' pt. i. concluded (1870), and A. S. Woodward, 'Catal. Foss. Fishes B.M.,' pt. ii. (1891), pp. 177–193, with figs.

not yet interpreted, perhaps related to the olfactory apparatus. A conspicuous ovoid plate behind the orbits fills a vacuity in the roof of the brain-case. Along each side of the head-shield there extends a long narrow vacuity filled with loose polygonal plates, which form a flexible roof to a chamber within the inrolled rim of the shield. I regard this chamber as branchial, for it opens behind just within the cornu (or postero-lateral angle) of the head-shield, where a flexible flap stiffened by polygonal plates may be regarded as an operculum. In some specimens of the closely-allied genus *Auchenaspis* (or *Thyestes*) there are indeed traces apparently of the branchial arches close to the chamber on each side*. The mouth must have been placed far forwards on the ventral surface, but no hard parts related to it have been observed. The body-cavity extended far back in the scaly tail,

Fig. 4.



Restoration of *Cephalaspis murchisoni* from the Downtonian Passage Beds of Herefordshire, about one-half nat. size. The head shown from above the tail twisted to be seen mainly in side-view.

where the remote cloacal opening has been seen. *Cephalaspis* has only one dorsal fin, but the median scales in front of it form a curious elevated ridge along the back, and two dorsal fins have been observed in the allied genera *Aceraspis* and *Micraspis* †. All the fin-membranes are scaly, without true fin-rays.

Auchenaspis (or *Thyestes*)‡ is closely similar to *Cephalaspis*, only having some of the anterior body-scales fused with the hinder border of the head-shield. *Eukeraspis* is interesting as showing the flexible roof of the pair of branchial chambers subdivided by cross-bars; while in *Trematapsis* § this roof is reduced

* J. V. Rohon, Verhandl. russ. k. min. Ges. St. Petersb. [2] vol. xxxiii. (1895), p. 17; also Bull. Acad. Imp. Sci. St.-Pétersb. vol. iv. (1896), p. 231, with figs.

† J. Kiær, Skrift. Vidensk.-Selsk. Kristiania, Mat.-naturv. Kl. 1911, no. 7, pp. 16, 17.

‡ J. V. Rohon, Mém. Acad. Imp. Sci. St.-Pétersb. [7] vol. xxxviii. no. 13 (1892), pp. 12–37, with figs.

§ W. Patten, Mém. Acad. Imp. Sci. St.-Pétersb. [8] vol. xiii. no. 5 (1903).

on each side to two widely-separated areas, which have been mistaken for marks of sense organs *. One remarkably preserved specimen of *Trematuspis* exhibits a small vertebrate brain of almost diagrammatic simplicity †: and several known shields of this genus are pierced above the position of the auditory organs by a pair of foramina which may represent the ductus endolymphaticus of each side. In *Trematuspis* and *Didymaspis* some of the anterior body-scales are fused into a plate both dorsally and ventrally, and this armour is firmly united with the head-shield. The extent of the dermal plates in these two genera is therefore as great as in the Heterostracan genera *Drepanaspis* and *Phyllolepis*.

The Osteostracans are connected with the most primitive Heterostracans, such as *Thelodus*, by *Ateleaspis* ‡, from the Upper Silurian Passage Beds, in which the polygonal plates of the head-shield are not fused together into a rigid covering. Indeed, if geologists are not mistaken as to the age of the rocks in which they occur, nearly similar polygonal plates are among the earliest known fish-remains, even so ancient as the Ordovician period. The plates named *Astraspis desiderata* §, said to be found in the Ordovician near Canyon City, Colorado, U.S.A., are essentially similar in microscopic structure to those of the Osteostracans, except that they lack the laminated inner layer—the part of the armour which theoretically would be latest in development.

Antiarchi.

The most highly specialised order of Ostracoderms occurs only in Middle and Upper Devonian formations, and its ancestral forms remain unknown. The head and the greater part of the trunk are covered with plates symmetrically arranged according to the disposition of the sensory canals; and a pair of movable lateral appendages, also encased in plates, is fitted anteriorly to the armour of the trunk. The small tail, ending in a heterocercal fin, is either scaly or naked. Bone-cells are present in all layers of the armour. The species of the Middle Devonian genus *Pterichthys*, familiar by the restoration of Traquair, attain a length of about 20 cm., while some species of the Upper Devonian genera *Bothriolepis* and *Asterolepis* are much larger ‖. They were first grouped as Antiarcha by Cope, when he supposed he saw some relationship between them and the Ascidians.

* C. Wiman, Bull. Geol. Inst. Uppsala, vol. xvi. (1918), p. 94.

† C. Wiman, *loc. cit.* 1918, p. 86, with text-fig.

‡ R. H. Traquair, Trans. Roy. Soc. Edinb. vol. xxxix. (1899), p. 834, pl. 4. figs. 6-12, text-fig. 2; also *loc. cit.* vol. xl. (1905), p. 883, pl. 2. figs. 9, 10, pl. 3, text-fig. 3.

§ C. D. Walcott, Bull. Geol. Soc. America, vol. iii. (1892), p. 166, pl. 3. figs. 6–14, pl. 4. figs. 1–4. C. R. Eastman, Proc. U.S. Nat. Mus. vol. lii. (1917), p. 238, pl. 12. figs. 5, 6.

‖ R. H. Traquair, 'A Monograph of the Fishes of the Old Red Sandstone of Britain,' pt. ii. (Palæont. Soc. 1894–1913).

The eyes in these Ostracoderms are median as in the Osteostraci, but the small plate between them, pitted on its inner face for the pineal body, is loose, and close to it there is a peculiar complication of parts which cannot yet be explained. Two external plates in front of the mouth are denticulated, as if they were related to the margin of the mouth itself; and they are notched at the outer lateral ends, as if for nostrils. At the postero-lateral angles of the head, where the branchial chambers seem to open in other Ostracoderms, there is a loosely-hinged plate on each side which may be regarded as an operculum. Markings on the inner face of some of the head-plates still await explanation.

The inner surfaces of the plates of the trunk as a rule exhibit no features specially related to the soft parts; but in one species, *Pterichthys rhenanus*, from the Middle Devonian of the Eifel, Germany, there is a peculiar structure which has hitherto escaped general consideration. It was first noticed by Rohon* in a specimen which I studied with him in Petrograd in 1892, and I have since observed it in a second specimen in the British Museum (no. P. 8882). This structure is a nearly horizontal thin lamina of bone, marked by a longitudinal median suture, and thus evidently paired, extending firmly fixed across the base of the anterior median dorsal plate and ending abruptly just in advance of the posterior border of the plate. In fact, it bounds below a large dorsal chamber which is widely open behind. The nature of this chamber is uncertain, but the vertebral axis must have been well below it; and it denotes a fundamental difference between the Antiarchi and the Arthrodira (such as *Coccosteus*), which are sometimes still regarded as related.

The tail in *Pterichthys* is covered with rhombic scales and clearly heterocercal, with a single small dorsal fin; but in the other genera it must have been scaleless, and it has only been observed in one species of *Bothriolepis* peculiarly preserved as a stain on the rock from one formation and locality †.

The discovery of the tail of *Bothriolepis* in specimens from one very thin layer of rock in a cliff which had already been examined by many skilled collectors, illustrates well the accidental nature of advances in our knowledge of fossils. Whole shoals of the same species had been found in other layers of the same section, but without a trace of the tail. In the course of this brief address I have mentioned several cases in which our present acquaintance with important facts depends on one or two favourably preserved or fortunately broken specimens. I have tried to show how a palæontologist correlates these isolated facts and arrives at least at a plausible conclusion. Our knowledge of all groups of extinct organisms has to be acquired in the same slow and laborious manner.

* J. V. Rohon, Verhandl. russ. k. min. Ges. St. Petersb. [2] vol. xxviii. (1891), p. 308, pl. 7. figs. 1, 2.

† W. Patten, Biol. Bulletin, vol. vii. (1904), p. 113, with figs.

Prof. F. E. Weiss then moved:—"That the President be thanked for his excellent address, and that he be requested to allow it to be printed and circulated amongst the Fellows," which resolution, having being seconded by Mr. H. N. Ridley, was put and carried with acclamation.

The President having acknowledged the vote of thanks, proceeded to address Dame Helen Gwynne-Vaughan, handing to her the Trail Award and Medal. He said:—

Dame Helen Gwynne-Vaughan,—

The Council of the Linnean Society gives to you the Trail Award and Medal as a mark of its appreciation of the researches in which you are at present engaged on the morphology and cytology of the fungi. For several years you have been a painstaking worker in cytology, especially in relation to fungi, and your early papers on the Ascomycetes may be particularly mentioned as important contributions to our knowledge. Among higher plants you have also studied to good purpose the vegetative divisions and the meiotic divisions of *Vicia Faba*. You have not only worked yourself, but have also stimulated others to follow the same fruitful course of research, and so have deserved well of our science. The Council looks forward with interest to the early publication of your new volume on the fungi, and I have much pleasure in handing to you this award and medal with its best wishes for your continued success.

The recipient returned her thanks.

The President then addressed Sir Ray Lankester, K.C.B., reciting his services to the study of Zoology, and handing to him the Linnean Medal in gold. He said:—

Sir Ray Lankester,—

The Council of the Linnean Society has awarded to you the Linnean Medal as a token of its admiration for your life-work in the advancement of zoological science. You have so completely traversed the whole field, not touching any subject without adorning it, that it is impossible briefly to enumerate your several services. You began early to combine a study of extinct animals with those now living, and your papers on fossils from the East Anglian Crag deposits and your classic monograph of Pteraspidian and Cephalaspidian fishes, published half a century ago, are pioneer works that will always retain their value. At the same time you devoted close attention to the Protozoa, especially gregarines and blood-parasites, and in 1871 you discovered the first known intracorpuscular parasite (*Drepanidium*) in the frog. Your early researches on the earthworm and other worms did much to elucidate the significance of the excretory organs (which you named nephridia), the cœlom, and the vascular system in Annelids.

You made fundamentally important observations on the development of the Mollusca (*Limnæa*, *Paludina*, *Cyclas*, etc.), determining among other matters the origin of the germ-layers; and you first clearly distinguished the true blood-vascular system from the cœlomic spaces in Mollusca and Arthropoda. You studied and described *Rhabdopleura*, an interesting colonial form in some respects intermediate between Polyzoa and Vertebrata (Protochordata). Among Arthropods, your valuable work on *Apus* was followed by your masterly exposition of the structure of *Limulus*, proving its relationship to *Scorpio* and thus separating it from the Crustacea. At the same time you contributed much to a proper understanding and classification of the Arachnida. Your researches on the structure and larval development of *Amphioxus* are of primary importance in vertebrate morphology; and your memoirs on *Okapia* and *Eluropus* are noteworthy contributions to our knowledge of the higher mammals. Since 1869 you have edited continuously the 'Quarterly Journal of Microscopical Science,' and kept it in the forefront of journals of zoology. You have also planned, edited, and partly written several volumes of an exhaustive Treatise on Zoology. You have stimulated work in others not only by your brilliant professional teaching and personal intercourse, but also by your more general writings, among which I may specially mention your articles in the 'Encyclopædia Britannica.' They are models of clear exposition, concentrating attention on the really essential and interesting points, with the omission of unnecessary detail. As one honoured by your friendship for the past thirty years, I can testify personally to the inspiring influence you have always exerted, and it gives me the greatest pleasure to be the means of handing to you this mark of esteem from the Council of the Linnean Society.

The recipient made an acknowledgment in reply as follows:—

Mr. President and Fellows of the Linnean Society,—

I beg permission to say a few words in order to express to you my deep sense of the great honour you have done to me in conferring upon me the Linnean Medal. I feel sensible not only of the distinguished honour given by your selection of me as its recipient, but of the great personal kindness and good-will which have influenced you, You, Mr. President, are an old friend and colleague of long-standing, and so are others whom I see here—and many have been associated with me as pupils and fellow-workers in the laboratory. The Linnean Society has been a constant source of help and advantage to me since many years ago I first used its library and published papers in its 'Transactions.' I became a Fellow forty-four years ago. My actual recollection of the Society goes back to the year 1855, when I went with my father to fetch books from its house—formerly that of Sir Joseph Banks—in Soho Square. From that time onwards I have known and been kindly helped in every way by its officers.

My father's friend, the distinguished surgeon, Mr. George Busk, was Secretary of the Society for some years, and taught me in his own study, when I was a school-boy, to dissect the earthworm. Huxley, Hooker, Allman, Lubbock, Gwyn Jeffreys, and Günther were my advisers and senior friends. They were succeeded as leaders of the Society by my coevals, and now a younger generation are joining in the government of the Society and in kindness to me.

I cannot sit down without especially thanking my friend our President for the selection of the Ostracoderm Fishes as the subject of his address to-day. It was delightful to me to hear his references to my work on these fossils, done more than fifty years ago—and many entrancing pictures of cornstone quarries, of the exciting discoveries of novel specimens, of dear old friends, collectors, and colleagues — of good-luck and adventure — the romance of the hammer—have been floating through my mind. I have never heard a lecture which gave me so much pleasure. Dr. Smith Woodward's own investigations on the Ostracoderm fishes have been of great importance, and the high value of his judgment in all that relates to them and other extinct groups is so well established, that I am most gratified to find that after all the additions to our knowledge of Ostracoderms since 1870 he is still able to speak of my pioneer work with kindly consideration.

The President reminded the Meeting that the General Secretary had that day completed 40 years as a Secretary, and the latter bowed in acknowledgment.

The General Secretary having laid on the table certain obituary notices, the proceedings terminated.

OBITUARY NOTICES.

Lieut.-Col. Linley Blathwayt, who died at Eagle House, Batheaston, his home for 37 years, was a member of the well-known family, the Blathwayts of Dyrham Park. He was the son of the Rev. C. B. Blathwayt, Rector of Langridge, where our late Fellow was born on 7th September, 1839. He entered Marlborough College in August 1850 and remained there till 1854, served in the Indian Mutiny Campaign with the 79th Highlanders, was present in China in 1860–62, the Bhutan Expedition in 1864–65, and then in civil employ in Assam and Chota Nagpur until his retirement in 1880.

On settling in 1882 at Batheaston, Col. Blathwayt took up scientific pursuits. In 1883 he joined the Bristol and Gloucester Archæological Society, our own Society 3rd December, 1885, and the Somerset Archæological Society in 1891; in the latter year

he was chosen President of the Bath Microscopical Society; he was also a Fellow of the Entomological Society. He helped to draw up a list of the insects of Somersetshire for the Victoria History of that county. Latterly he had interested himself in bamboo culture, and made a list of 42 Bambuseæ in his garden. He left a widow and one son and one daughter. By his special request he was cremated. [B. D. J.]

William Gilson Farlow died at his home in Quincey Street, Cambridge, Massachusetts, on 3rd June, 1919, after an illness of three weeks. He was a frequent visitor to our country before the war, and his striking personality, his irrepressible humour and wide humanity, as well as his scientific distinction, secured him a joyful welcome. A keen sense of personal loss is felt by his many friends here.

Farlow was born in 1844, and graduated from Harvard College in 1870 with the degrees of A.M. and M.D., the medical course having been taken as a preparation for a scientific career. Botany and music were the pursuits that attracted him most during his student days. He had, indeed, already showed a strong predilection for cryptogamic botany, and after graduation he acted as assistant to Asa Gray. His first publications were 'Cuban Sea-weeds' (1871) and 'List of the Sea-weeds and Marine Algæ of the South Coast of New England' (1871-1872). He relinquished his post in 1872, at Gray's advice, in order to continue his botanical studies in Europe. He first directed his course to Scandinavia, where he visited the elder Fries, Areschoug, and J. G. Agardh, and had the opportunity of examining their herbaria. His next journey took him to St. Petersburg to see the Ruprecht Herbarium of Algæ. Most of his time, however, during these "wander years" was spent in a definite course of botany under the direction of de Bary at Strassburg. The students in de Bary's laboratory were given a decided bias towards cryptogamic botany, more especially fungi, and Farlow shared in the enthusiasm for this side of botanical research, though his first published investigation was on apogamy in Ferns: 'An asexual growth from the prothallus of *Pteris cretica*' (1874). Before leaving Europe, he devoted some weeks to an intensive study of lichens at Geneva with Jean Mueller. Finally, a French tour took him to Antibes and the French algologists, Bornet and Thuret.

On returning to America in 1874, Farlow was appointed to an assistant professorship at Harvard. His work during the following years dealt largely with plant pathology, and he published a series of papers on various destructive parasites. In 1879 he became Professor of Cryptogamic Botany, a position he occupied until his death, though he retired from active teaching in 1896 and devoted himself to the care and development of the herbarium and library. His publications during these years of activity were many and various; they dealt not only with scientific discovery, but with questions such as the 'Conception of Species' and the

'Laws of Nomenclature.' His book 'The Marine Algæ of New England' (1881) gives descriptions of genera and species and an artificial key to the genera. He compiled a 'Provisional Host Index of United States Fungi' (1888–91), and along with Seymour edited the 'Bibliographical Index of North American Fungi' (1905). He had also prepared and printed plates for a work on fleshy fungi, which has been left uncompleted.

Professor Farlow was intimately associated with British workers, and when the 'Annals of Botany' was founded he at once accepted the post of American editor. He did much to maintain friendly relations between the botanists of English-speaking countries. Among the many honours awarded to him were the Foreign Fellowship of the Linnean Society (1892) and the Honorary Degree of LL.D. of Glasgow University (1910). [A. L. Smith.]

Ernst Heinrich Philipp August Haeckel was born at Potsdam in 1834. He came of a long line of legal families on both sides. Before he was a year old, his father, a Government law official, was transferred to Merseburg, in Saxony, and there all his school-days were passed. Before they were over, however, his father had retired from Government service and removed with his family to Berlin.

As a child he showed the love for nature and the fondness for drawing which were intensified as he grew older. Botany was his first love, and it is interesting to read that as a boy of eleven he spent a whole day on the Siebengebirge, hunting for *Erica cinerea*. At about this age he began to form an herbarium, and made a fruitless effort to determine and distinguish the "good and bad species" of willows and blackberries. In his school holidays he met Schleiden in Berlin, and was much attracted to and influenced by him. Schleiden was Professor of Botany at Jena, and the young Haeckel visited him there, and made arrangements for a course of botanical study. After his final school examinations were passed he went to Jena, but his stay and botanical studies were cut short, owing to a bad attack of rheumatism, the result of searching for *Scilla bifolia* in the damp meadows of Saale on a cold March day. He had to go home to Berlin to be nursed, and did not see Jena again for many a long day.

Haeckel worked at botany under Braun in Berlin, but his father could not look upon scientific research as a calling, so to please his father he went in 1852 to Würzburg as a medical student. Here he came under the influence of Kölliker, Virchow, and Leydig, and here, too, he came in contact with Gegenbaur, who had recently returned from Messina, where, along with Kölliker, he had been working on Medusæ. Gegenbaur's account of the work done at Messina and the wonders of marine life so enthralled the young and enthusiastic Haeckel that he resolved to go there and do likewise on the first opportunity. In 1854 he returned to Berlin, and for a year or more worked at zoology under Johannes Müller, who took him to Heligoland to study

marine animals. Haeckel had many great teachers, but Johannes Müller influenced him more than any of them.

In 1855 Haeckel returned to Würzburg to get on with his medical studies, much against his inclination, but in 1856 he managed to get to Nice along with Kölliker and others for further marine investigations. He afterwards returned home to Berlin to prepare his dissertation for the doctorate, which was on a piece of zoological work, 'De telis quibusdam Astaci fluviatilis.' On obtaining his degree he was sent by his father to Vienna—a safe distance from the sea—where he walked the hospitals, and managed to pass the State examination in Medicine in 1858. He was now qualified to practise, and he settled in Berlin so as to have access to Johannes Müller's laboratory. Unfortunately, Müller's sudden death upset all Haeckel's plans, but he began to practise, and not wanting to be disturbed in his zoological work by too many patients, he fixed his consulting hours from 5 to 6 A.M.! The result was that during a whole year he had only three patients, and none of them died. "This success was enough for my dear father," says Haeckel, and the old man consented to his son having one more year to seriously study marine animals. Early in 1859 Haeckel reached Italy, travelling slowly and sketching as he went along. He reached Sicily in the autumn, and settled down at Messina for six months to the study of the Radiolaria. On this journey he discovered his talent for landscape painting, and was nearly diverted from zoology to live the life of an artist.

In 1861 Haeckel was still depending on allowances from his father, and something had to be done; so he went to Jena to see his old friend Gegenbaur, who was now occupying the Chair of Zoology there. By his advice he settled in Jena as a *Privat-docent*. In the following year he was appointed Extraordinary Professor of Zoology, and published his first monograph on the Radiolaria; and in that year, too, he married his cousin Anna Sethe. In 1865 a special Chair of Zoology was founded for him at Jena; and though he received many invitations to fill other Chairs of Zoology, he made Jena his home for the rest of his life.

Haeckel read the 'Origin of Species' in 1860, after his return from Messina, in a German translation by Bronn. The book "profoundly moved" him. He was not long in accepting Darwin's views against the immutability of species, and planned the classification of the Radiolaria on lines of evolution, and also constructed a genealogical tree. Haeckel was the first to champion the cause of Darwinism in Germany against the strongest opposition. He became an enthusiastic evolutionist and devotee of Darwinism, which thoroughly permeated all his teaching and all his writings.

In 1864 his wife died, and in order to assuage his grief he wrote his 'Generelle Morphologie' (1866), bearing the sub-title 'General elements of the science of organic forms, mechanically grounded on the theory of descent as reformed by Charles

Darwin.' For general biological clsssification it inaugurated a new epoch, and Huxley described it as "one of the greatest scientific works ever published." In this work he repeatedly insists on the importance of the "Fundamental Biogenetic Law," which may be briefly stated in his own words, "Ontogeny repeats Phylogeny." The book did not attract much attention from the general public, so he wrote a *resumé* of a part of it in popular form under the title of 'Natürliche Schöpfungsgeschichte,' and it was a great success. It naturally brought storms about his head, but it also brought him a following apart from that formed by his scientific friends and pupils. An English translation under the editorship of Sir E. Ray Lankester appeared in 1879, under the title of 'The History of Creation.'

In 1866 Haeckel went to the Canaries, visiting England and Darwin at Down on the way. There he worked at the Medusæ, and especially the Siphonophores. It was during this visit that he became interested in Sponges, but it was not until 1872 that his great monograph on the Calcispongiæ was published. In this he formulated his Gastræa-theory, which was really a special application of the Biogenetic law. In subsequent years he elaborated his studies on the Gastræa, and published them in one book in 1877.

In 1867 he married Agnes Huschke, the daughter of the distinguished anatomist at Jena. They had three children, a son who became an artist, and two daughters.

Another large treatise appeared in 1874 under the title of 'Anthropogenie,' and in it Haeckel applied his fundamental Biogenetic law to the evolution of Man. The book is in two parts; the first being on Ontogeny, practically a philosophical text-book on Human Embryology, while in the second part Phylogeny treats of the foundations of Anthropology. (The 5th Edition was translated into English under the title of 'The Evolution of Man,' 1905.) After giving an account of the evolution of the various tissues and organs of Man's body, he goes on to the evolution of Man's soul, the psychic organ being the brain. "The human soul or psyche, as a function of the medullary tube, has developed along with it; and just as brain and spinal cord now develop from the simple medullary tube in every human individual, so the human mind or the psychic life of the whole human race has been gradually evolved from the lower vertebrate soul." Logically, therefore, both proceed from the very primitive soul of Man's Protozoon ancestors. In 1876 he published a short essay, 'Die Perigenesis der Plastidule.' This is one of his most remarkable pieces of work. Hering in 1870 had shown that memory must be considered a general function of organic matter, and that reproduction and inheritance can only be explained by admitting the existence of this unconscious memory. In the above mentioned essay Haeckel elaborated this idea. He resolved cells into plastidules (molecules), and applied the physical principle of transmitted motion to them. In his own words: "I concluded

that Heredity is the memory of the plastidules and variability their power of comprehension." This work was followed in 1878 by 'Cell-Souls and Soul-Cells' and other essays on Evolution.

In 1879 Haeckel published his 'System der Medusen,' a large folio work, comprising not only his own researches, but those of all others who had gone before him. On the return of the 'Challenger' Expedition he received from the British Government the collections of Radiolaria, Keratosa, Siphonophora, and Medusæ. In the Report on the Siphonophora the opportunity was taken to include the results of his visit to Ceylon and other places, and most of the beautiful figures which illustrate the specimens were drawn from life by him. In judging Haeckel's systematic work it is necessary to bear in mind that he was a man who possessed a very fertile imagination, an artistic temperament, and a great keenness for Evolution. In all his monographs he drew up new classifications based upon Evolution, and once he got his imaginary scheme completed, then it was only a question of making the species fit into it. He was an expert at reconstructing an animal out of a fragment, and it was wonderful, when finished, how well it fitted into his classification. A previously described species that would spoil or interfere with his system of classification received an amended description, owing to its author, as Haeckel considered, having overlooked the essential characters which were wanted. Haeckel's strong imaginative powers and his enthusiasm for Evolution were against him as a good systematic zoologist. He was too fond of reconstructing imaginary species out of bad material to fit his views on Evolution, and under the influence of his artistic temperament the pencil would tend to convert ugly things into beautiful ones. It was not deliberately done, but his enthusiasm for Evolution and Art led him astray. The climax in monographs was reached with the 'Challenger' Radiolaria (1887). The text consisted of 2700 pages and the figures covered 140 plates. Over 3000 new species were described.

In 1881 Haeckel went to Ceylon for a few months with all the outfits of a marine zoologist, botanist, photographer, and artist. This trip he thoroughly enjoyed, and he gave an interesting account of his work and experiences in a book translated under the title of 'A Visit to Ceylon.' In subsequent years he visited most of the countries in Europe, Italy being his favourite, appealing most to his artistic tastes. He also made expeditions to North Africa, Asia Minor, Red Sea, and the East Indies. As he grew older his love for painting was more indulged in on his travels, for he could not resist painting, either in oil- or water-colours, a landscape that held him in enchantment, any more than collecting animals and plants for his museum.

On the completion of the 'Challenger' monographs Haeckel practically gave up systematic work and turned his attention more closely to his works on Evolution and his philosophy of Monism, in which he acknowledges nothing supernatural, but conceives a God who embraces Nature and at the same time is

one with Nature, organic and inorganic. A great work, 'Die Systematische Phylogenie,' appeared in 1894–96. It was a sketch of a natural system of organisms on the basis of their stem-history, and dealing with the Protists, plants and animals. In the 'Riddle of the Universe' he published a popular study of his Monistic philosophy, and the book had an immense sale, being translated into over a dozen different languages. It was followed by a supplementary volume, 'The Wonders of Life.' Haeckel was a firm believer in the Inheritance of Acquired Characters, and regarded it as "one of the most important principles in evolutionary science." He was consequently a strong opponent of Weismann's theory of the Continuity of the Germ-plasm, and not a supporter of De Vries's Mutation-theory.

He was an adept at coining names, usually derived from Greek, for use in his systematic classification and for text-books. To him zoologists are indebted for many words now in common use, such as:—Ontogeny, Phylum, Protozoa, Protista, Metazoa, Plankton, Cœlom, and Gastrula.

It is impossible within the limits of an obituary notice to give more than a brief outline of Haeckel's activities, for he was a prodigious and vigorous worker. Students flocked to his class-rooms at Jena, and his courses of semi-popular lectures on Evolution were fully attended by all sorts and conditions of people, from far and near. In the prime of life he was a fine, handsome man, with a strong but charming personality, fearless in expressing his Evolutionary views, which were by no means favourably received by the multitude, and attempts were even made to eject him from his Chair of Zoology.

At the time of the outbreak of the Great War, Haeckel had reached the age of eighty, and was resting, with the infirmities of old age upon him, after the labours of his long and strenuous life. The fact that Britain honoured her treaty with Belgium and declared war upon his Fatherland aroused into activity his latent Prussian Soul-cells, and he attacked England, with his pen, with more bitterness and hatred than he ever did his strongest opponents on Evolution and Monism. This eruption may be passed over and put down to "Senility," for it was against his later years' motto: "The good, the true, and the beautiful, are the ideals, yea the gods, of our Monistic philosophy"; and besides he had many old friends in England, and had received most of the honours that she could give him, including the Honorary Foreign Membership of the Linnean Society and its Gold Medal. He lived to see the end of the war, and, after a prolonged illness, died in his beloved town of Jena on 8th August, 1919, at the age of 85. [E. T. Browne.]

John Hopkinson was born at Leeds on the 15th November, 1844; his father and uncle having recently and successfully established the firm of J. & J. Hopkinson, pianoforte makers, transferred it in 1846 to London, whither in 1856 the whole

family migrated. The subject of this notice first went to a day-school in London, and later to a boarding-school at Berkhamsted. Here it was, when 15 years old, he began to show a bent towards science, amongst other things collecting plants, and displaying so keen a liking for botany, that when some years afterwards his old schoolmaster was about to leave England he gave his herbarium, containing many specimens collected by the Rev. C. A. Johns, to his former pupil.

In 1860, at the age of 16, John Hopkinson passed direct from school to his father's business, and remained in its active prosecution for 53 years; during this long period his evenings were given up to scientific pursuits. The first society he joined was that of the Geologists' Association in 1865; two years later the Royal Microscopical Society, and in 1869 the Geological Society of London. It was in 1868 that he read his first paper on British Graptolites before the Quekett Club; the subject took up much of his attention for several years, until the claims of administration of a local society obliged him to concentrate his attention upon the latter. In 1874 he removed to Watford, and in the late autumn of that year, in conjunction with Dr. Alfred T. Brett and Mr. Arthur T. Cottam, a preliminary meeting of local naturalists was held, leading in January 1875 to the establishment of the Watford Natural History Society, with Mr. John Evans (afterwards knighted) as the first president and Mr. Hopkinson as secretary, librarian, and editor; the last-named office he retained to the closing day of his life.

He was elected into the Linnean Society on the 18th February, 1875, and served on the Council from 1908 till 1911. As the years passed on, he came to use the library more extensively, and in recent times he was in our rooms several times each week, largely for the volumes issued by the Ray Society.

In 1877, he married Miss Katherine Willshin, of St. Albans, who survives him, with two married daughters.

In 1879 the Watford Natural History Society enlarged its scope and changed its name to the present one, The Hertfordshire Natural History Society, of which renamed society Mr. Hopkinson remained the active and energetic officer to the end of his life. In the same year, at the British Association meeting at Sheffield, he urged that an annual conference of delegates of various provincial societies should take place, and the originator of the plan presided over the first conference, which was held at Swansea the following year. These gatherings were at first not officially recognised, but they now form a part of the programme at each meeting of the Association.

Another suggestion which took some years to develop was that of a local museum at St. Albans; in 1896 a temporary building was opened and the new permanent one the next year. In 1900 Mr. Hopkinson transferred the greater number of his meteorological instruments to the museum, together with his herbarium (previously mentioned), his local collection of mollusca and

his fossils, except a special selection of graptolites which he gave to the Woodwardian Museum, Cambridge. At this time he left St. Albans and settled again at Watford in the house built by his father, which was his home to the end.

The affairs of the Ray Society became of increasing interest to Mr. Hopkinson; in 1889 he became a member of the Council, in 1899 the treasurer, and in 1902, upon the death of the Rev. Thomas Wiltshire, its secretary and centre of its activities.

In 1913 he retired from business, when his firm was turned into a company, remaining on the board as a director; from this time he was free to employ his full time in the service of the two societies so dear to him. During the war he was compelled to relinquish evening meetings as, owing to the reduced lighting and his own extreme short-sight, he was handicapped in walking.

To the last our late Fellow was alert and vigorous, and probably his last visit to any of the societies to which he belonged was to our Society on the afternoon of Friday, July 4th, 1919, when he discussed a point of administration of the Ray Society; a few hours later he was dead of heart failure, early on the morning of the 5th July, leaving a gap in the band of earnest naturalists not easily to be filled. He was buried on Thursday afternoon, 10th July, at Watford Cemetery, Mr. Charles Oldham and Mr. Wilfred Mark Webb representing the Linnean Society.

[B. D. J.]

The ranks of critical British botanists have sustained a severe loss by the unexpected death of the Rev. Edward Shearburn Marshall on the 25th November, 1919.

Born in Park Lane on the 7th March, 1858, our late Fellow was privately educated in England and Germany, entering Marlborough College in September 1873, where he remained nearly four years, obtaining an Old Marlburian Scholarship (1876) the year after he left, an Exhibition, and a Scholarship at Brasenose College, Oxford. At the University he took a Second Class in Classical Moderations in 1879 and a Third Class in History in 1881, the year he graduated B.A., proceeding M.A. in 1884. He was at Wells Theological College in 1882, ordained deacon in 1883, and priest in 1885, the Marlborough Mission at Tottenham supplying his title to orders.

From this curacy he moved to another at Witley, Surrey, and whilst there he married on 16th August, 1887, Fanny Isabel Foster, a niece of Birket Foster, the water-colour artist. In 1890 he became Vicar of Milford, where he stayed ten years; from 1900 02 he was Curate-in-charge of Lavington-cum-Graffham, Sussex, then Vicar of Keevil in Wiltshire, and in 1904 he became Rector of West Monkton, his last clerical post.

He had complained for some years of fits of depression, which increased in intensity and frequency; in the middle of 1918 he suffered from a nervous breakdown, even fainting in the pulpit. Acting on medical advice, he made arrangements for withdrawing

from pastoral work, and in 1919 he bought an estate at Tidenham, near Chepstow, naming it 'Offa's Dyke.' It was hoped that the release from parish work would relieve the depression, but family cares deepened the gloom; the loss of his only brother, due to an accident, followed by the illness and death of his wife, and doubts about his policy in having bought a large estate with possible financial trouble—a purely imaginary trouble—resulted in his being found dead in his room on the 25th November, due to the action of poison.

Although our late Fellow was at Marlborough at the time when the Rev. T. A. Preston (1833–1905) was active as a naturalist in the School (Proc. Linn. Soc. 1904–05, pp. 49–50), it is practically certain that his attraction to botany was acquired at Oxford. His first contribution was a modest paragraph in the 'Journal of Botany' for 1885, on *Pinguicula alpina* in Scotland, the first of a series of articles in the same journal which amounted to 246, extending over thirty volumes of that serial, and embracing reviews, catalogues of plants observed in various parts of the kingdom, as well as critical remarks on such genera as *Epilobium*, *Carex*, and the like.

The chief contribution to the botany of his native land was his carrying through the publication in 1899 of the 'Flora of Kent,' which had been in progress in the hands of Mr. F. J. Hanbury since 1872; to the same pen is due the summary of the Kentish Flora which appeared in the Victoria History of the County (1908): the 'Supplement to the Flora of Somerset' was undertaken at the instance of the Somersetshire Natural History Society; it came out in 1914: the account of the genus *Betula* in the Cambridge 'British Flora' was due to him; and many contributions to the works of others were written by him. His critical acquaintance of British plants led to his being constantly appealed to for decisions on doubtful forms, and besides the articles in the 'Journal of Botany' already mentioned, he contributed much to the reports of the two Exchange Clubs, of which he was an active member almost to the last.

Two plants were named after him, *Hieracium Marshalli*, E. F. Linton, and *Rubus Marshalli*, Focke & Rogers; another *Hieracium* was named by him in honour of his wife, *H. Isabellæ*.

For the above account the writer has to acknowledge his indebtedness to the Editor of the 'Journal of Botany,' where in the first number of the present year (1920) appears a sympathetic and detailed review of the lifework of our late Fellow, accompanied by portraits of husband and wife. [B. D. J.]

The Rt. Hon. Alexander Peckover, Baron Peckover, was born at Wisbech 16th August, 1830, and was directly descended from Edmund Peckover, a trooper in Cromwell's army, and whose landed estate at Fakenham, Norfolk, he possessed. He was educated at Grove House School, Tottenham, and became a partner in the bank of Gurney, Peckover & Co., of Wisbech,

in which he spent his business life. In 1907 he was created Baron Peckover, a title which lapsed on the death of the first holder, as three daughters but no son formed his family; his wife, the only daughter of J. Sharples, of Hitchin, whom he married in 1858, died in 1862. From 1893 to 1906 he was Lord Lieutenant of Cambridgeshire, the first instance of a member of the Society of Friends filling such a post. He delighted in collecting ancient manuscripts, early bibles, and maps, amassing a splendid library, and in early life he was devoted to chess, cricket, and tennis. He died at Bank House, Wisbech, on the 21st October, 1919.

[B. D. J.]

Professor Magnus Gustaf Retzius, whose death at the age of 77 occurred at Stockholm on 21st July, 1919, was one of the most distinguished zoologists Sweden has produced. Born at Stockholm 17th October, 1842, and descended from a grandfather who was Professor of Natural History at Lund, and a father who was Professor of Anatomy at Stockholm, he doubtless developed his remarkable scientific gifts in a congenial environment. His work ranged over a wide field, and soon won him recognition as an authority on such diverse subjects as histology and anthropology. In conjunction with Prof. Axel Key, he wrote in 1875 a standard work on the cerebro-spinal membranes and spaces, and later brought out a series of monographs on the internal ear, the microscopic structure of the nervous system and sense organs of various animals, the structure of spermatozoa and nuclei—all illustrated with a magnificence which has never been surpassed. Important work was also published by him on the brain of Man and of anthropoids. Retzius did much to forward the study of anthropology in Sweden, and his 'Atlas of ancient Swedish skulls' (1900) and 'Anthropology of Sweden,' written along with Prof. Karl Fürst (1902), are contributions of permanent value. Some of his conclusions were given in his Huxley Lecture delivered in this country.

He was elected a Foreign Member of the Linnean Society on the 6th May, 1909, and of the Royal Society in 1907; he also received the honorary degree of Sc.D. at Cambridge, and at many Continental universities a similar degree in the faculties of medicine and philosophy. [E. S. G.]

Simon Schwendener, who was elected a Foreign Member of the Linnean Society in 1884, was born at Buchs, in the Canton of St. Gallen, Switzerland, on 10th February, 1829. His father was a farmer, but the son early evinced an inclination for scientific rather than for agricultural pursuits. On leaving school he qualified as a teacher in the elementary school of his native town. A University education seems to have been, at first, beyond his means, but a bequest from his grandfather made it eventually possible. He began his University career at Geneva, studying botany under Alphonse de Candolle, but it was soon interrupted.

by the exhaustion of his resources, which involved a return to school-teaching. However, in 1856, he was in a position to remove to Zürich to resume botanical work under Oswald Heer, and in that year he graduated with a phænological thesis, 'Ueber die periodischen Erscheinungen der Natur, insbesondere der Pflanzenwelt,' which he had begun at Geneva.

Schwendener soon came into relation with Naegeli, who had recently moved to Zürich from Freiburg i./B., and with his assistance began the study of the microscopical anatomy of plants. The result was that when Naegeli was called to the Professorship of Botany at Munich (1857), Schwendener accompanied him as his assistant. After ten years at Munich, Schwendener was appointed Professor of Botany at Basel: ten years later (1877) he moved on to Tübingen, where he succeeded Hofmeister; and in 1879, on the death of Alexander Braun, he became Professor of Botany at Berlin, where he spent the remainder of his life. He died on 27th May, 1919. He was never married.

His first considerable work was 'Das Mikroskop,' written in collaboration with Naegeli, published 1865–7 (2nd edn. 1877), a book which contributed materially to the development of modern Botany. Schwendener was especially responsible for the part of it dealing with the mechanism and the optical theory of the microscope; he discharged his responsibility with conspicuous success that showed the natural bent of his mind to the mathematical. As a matter of fact, Schwendener was not a naturalist, and was rather contemptuous of systematic Botany and field-work. However, at this period he was actually engaged upon a piece of definitely botanical work, investigating the structure of Lichens, the results of which were published in Naegeli's 'Beiträge zur wisschenschaftlichen Botanik,' 1860–3–8. At that time much interest was being taken in the nature of the coloured cells containing chlorophyll, known as "gonidia," which are a constituent of the Lichen-thallus. The resemblance of these gonidia to free-living organisms considered to be Algæ was recognised, and the prevalent view was that these so-called Algæ were merely Lichen-gonidia which had escaped from the thallus and continued to live as free organisms. The conjecture had been hazarded that the facts could be interpreted in precisely the opposite way: that the gonidia are really Algæ which have become enclosed by and imprisoned in the colourless filamentous tissue of the growing Lichen-thallus. Schwendener was led by his observations to adopt and support the latter view. In 1869 he published his celebrated work, 'Die Algentypen der Flechtengonidien,' in which he adduced convincing evidence that the gonidia do not originate in the thallus, but are Algæ which have become invested or invaded by the mycelium of a Fungus. This led on to the striking inference that a Lichen is not a simple organism, but is composite, consisting of Algæ and Fungus living together in a relation which, on the whole, is one of mutual advantage—an altogether new biological conception which de Bary termed

"symbiosis." The passionate opposition of the professed lichenologists was aroused, a veritable "odium lichenologicum" prevailed, and even now the controversy has not altogether died out. However, the more the actual facts are investigated, the stronger becomes the position of the Schwendenerian theory, which is now almost universally accepted.

Schwendener's contribution to the right understanding of Lichens is his first claim to remembrance as a botanist. His second claim is that he founded and prosecuted, to some extent, the study of physiological anatomy. After 1870, his research was confined to the study of the anatomy of plants in relation to function. Whilst at Basel he published two important works, in which the application of mechanical principles to explain the structure and development of plants was the prominent feature. The first was 'Das mechanische Prinzip im anatomischen Bau der Monokotylen' (1874), in which it was shown that the distribution of the supporting-tissue (stereom) in these plants is in accordance with recognised principles of constructive engineering. The second was 'Die mechanische Theorie der Blattstellungen' (1877), in which he discussed the relation between the various forms of phyllotaxis and the mechanical conditions under which the leaves are developed.

During his Berlin-period, Schwendener published, mostly in the 'Monatsberichte' of the Prussian Academy, a number of papers on various physico-physiological subjects, such as the twining of stems, the ascent of sap, the mechanism of the stomata and of the pulvini of leaves, etc. He inspired a number of his students to pursue research in the direction of physiological anatomy, of whom Professor G. Haberlandt, now his successor at Berlin, is the most famous. [S. H. Vines.]

Sir Peter Wyatt Squire, born on 6th February, 1847, the son of Peter Squire, was educated at King's College School, and entered his father's business of pharmaceutical chemist. His publications were chiefly concerned with pharmacy, but in 1867 he was appointed chemist on the medical staff of the Royal Household. For his services in this appointment for more than fifty years he was knighted in June 1919.

His great recreation was punting, and he wrote the section on that sport in the Badminton Library. He died at his house, 'The Ryepeck,' at Shepperton, on the 17th September, 1919; his election as Fellow of our Society dated from the 1st November, 1877. [B. D. J.]

James William Helenus Trail was born at Birsay, Orkney, on the 4th March, 1851, the youngest son of the Very Rev. Samuel Trail, minister of Birsay and Harray, afterwards Professor of Systematic Theology at Aberdeen 1867–87, and Moderator of the General Assembly of the Church of Scotland in 1874.

His early education was carried out at home, Tulloch's private school, and the Grammar School of Old Aberdeen, where, owing to the extreme classical drill there prevalent, he took a violent dislike to the classics. As a child he had been accustomed to the observation and collection of natural objects, which tendency had been encouraged at Tulloch's school, and this proclivity was continued after his entrance into the University in 1866; here he did not seek distinction in classics, mathematics, or philosophy, concentrating his attention in the natural science department, obtaining highest honours when he graduated M.A. in 1870.

At that time the medical faculty provided the only avenue offered by the University for the student desirous of following science, and Trail was not specially drawn to his purely professional studies; but he served in 1870–73 as assistant to the professors of botany and chemistry and to the curator of the zoological museum. In 1873 he interrupted his medical career by accepting the position of naturalist to a South American exploring expedition, and was thus able to travel more than 16,000 miles on the Amazon and its northern tributaries, making full notes and collecting both plants and animals. On his return in 1875 he resumed his medical studies and set about the arrangement and publication of his results. In the following year he graduated M.B. with highest academical honours.

He was chosen in the same year (1876) to fill the post of botanist in British Guiana, but in 1877, when about to take up his duties, Dr. G. Dickie resigned his Chair, and Trail was appointed by the Crown to succeed him, beginning his career as Professor of Botany in May. The Chair of Zoology fell vacant in 1878, and Trail deputised for the new occupant during 1878–79 with signal success.

On taking up his new duties Trail found the equipment of the botanical department very defective. By 1879, when he proceeded to the degree of M.D., he had formed his plan and begun to carry it out, until he left for his successor an excellent teaching museum, laboratories, and a botanical garden.

From 1871 onwards Trail had published papers on galls in the 'Scottish Naturalist,' and in 1883 Dr. Buchanan White resigned its editorship and persuaded Trail to take over the duties from 1884, until it was merged, in 1892, in the 'Annals of Scottish Natural History,' and he acted as botanical editor during the twenty years that the 'Annals' were published.

The year 1886 witnessed Trail's part in the foundation of the Aberdeen Working Men's Natural History Society, frequently guiding its discussions and sometimes taking the lead in its excursions; this help was acknowledged by the Society annually electing him its president.

In 1891 the University Commissioners required a report on the condition of the library. Trail, who had served continuously on the library committee since 1877, was constituted curator of the library and chairman of the committee, and to draft the report;

he succeeded so well that he was annually re-elected to both posts. In 1892 he was appointed Dean of the newly-established Faculty of Science; the year following he was elected F.R.S.

The year 1895 laid another duty upon the professor: his friend Buchanan White had died, leaving his MS. 'Flora of Perthshire' advanced, but not finished for publication; Trail undertook the task, and with the help of friends accomplished it by 1898. The College of Agriculture was founded in 1903, Trail having taken a prominent part in the preliminary arrangements; he was also president of the Buchan Field Club till 1904, when he retired.

The last ten years of his life were spent in gathering and arranging materials for a projected 'Flora of North-Eastern Scotland' on a wide basis. After 1913 the strain of war conditions prevented his usual visits to London, and with the cessation of the war, the sudden increase of students involved the professor in extra exertions. After a short illness, due to a duodenal ulcer, his strength failed, and he passed away on the 18th September, 1919, aged 68.

Trail founded three funds:—1. In memory of his mother to assist undergraduates in any of the faculties who may display approved proficiency in Natural History studies. 2. On completing a quarter of a century's service as curator of the University library, for use in supplement of regular grants from the University exchequer, for the purchase of scientific books. 3. The third fund which especially affects this Society, in 1909, a sum "for encouragement on researches on the nature and properties of protoplasm": see 'Proceedings,' 1908–09, p. 94, with the constitution set out in the 'Proceedings,' 1914–15, pp. 52, 53. This fund was used to provide a bronze medal, which, together with the balance of the fund, is bestowed every five years, the two previous recipients being Prof. E. A. Minchin and Dr. L. Doncaster; the award to be made this year has been allotted to Dame Helen Gwynne-Vaughan, D.Sc., F.L.S.

For the facts recorded in the foregoing lines, the writer has to thank Sir David Prain, C.M.G., C.I.E., F.R.S., for his kind permission to use the obituary printed in the Proc. R. Soc. B. vol. xci. A bibliography of Professor Trail's work will be found in the 'Kew Bulletin,' 1919, pp. 381–388, and 1920, pp. 32, 33.

[B. D. J.]

William James Tutcher was born near Bristol in 1867 and educated at the Merchant Venturers' School in that city; after five years' experience in private gardens, he came to Kew as a young gardener. In two years he was promoted to sub-foreman and put in charge of the orchids. In 1891 he was appointed assistant to Mr. Charles Ford at Hongkong, and spent nearly thirty years in that island. In due course he succeeded to the post of Superintendent of the Botanical and Forestry Department, and spent most of his spare time in botanical exploration. The year 1912 witnessed the publication of the 'Flora of Kwantung

and Hongkong' by Messrs. S. T. Dunn and W. J. Tutcher, Additional Series x. of the 'Bulletin of Miscellaneous Information,' of the Royal Botanic Gardens, Kew. The herbarium of the department has naturally the bulk of Mr. Tutcher's collected specimens, but duplicates are at Kew and Manila.

The genus *Tutcheria*, Dunn, commemorates our late Fellow, who discriminated the tree in the Hongkong gardens; he himself described *Quercus Elizabethæ* after his wife. He was elected a Fellow of this Society 15th December, 1904, and was looking forward to a holiday at home, when he was attacked by pneumonia, and succumbed in March of the present year, leaving behind a record of successful work and diligent performance of duty. [B. D. J.]

Prof. George Stephen West, M.A., D.Sc., A.R.C.S., died at his home, 13 Pakenham Road, Edgbaston, Birmingham, on the 7th August, 1919, at the early age of 43, from pneumonia.

He was born at Bradford in 1876, the second son of his father, Mr. William West, a successful teacher and ardent naturalist. Our late Fellow was educated at Bradford Technical College, the Royal College of Science at South Kensington, and St. John's College, Cambridge; he obtained 1st Class in both parts of the Natural Science Tripos, in 1897 and 1898 respectively, became a Scholar and Hutchinson Research Student at St. John's, and acted as demonstrator in botany in 1899; but here his stay was brief, for in the same year he received the appointment of professor of natural history at the Royal Agricultural College, Cirencester, until 1906. In that year he became lecturer in Botany at the University of Birmingham, then, on the resignation of Prof. W. Hillhouse, he succeeded to the Chair of Botany from 1909 until his death.

His early publications were written in conjunction with his father (1848–1914), as noted in our 'Proceedings' for 1913–14, pp. 65–67. Brought up in an atmosphere of botanic activity, the son of a prominent algologist, the younger West followed in his father's steps, devoting his early attention to freshwater algæ, a subject upon which he became the leading exponent in the United Kingdom, and was pursued to the close of his life. Speaking generally, from 1893 or thereabout, his work was associated with that of his father, until when, a few years before the death of the elder West, whose attention had been increasingly drawn to the ecological study of the bryophytes and lichens, the algological portion of their joint labours became more and more the province of the younger West.

Much of their joint publications appeared in serials and journals, and we may specify the work on the algal flora of Yorkshire (1900–01), the Scottish lochs (1905), Irish lakes (1902–1906), Freshwater Algæ of Burma (1907), English lakes (1909), the Driva Valley in Norway (1910), culminating in the volumes on the British Desmidiaceæ, four volumes published by the Ray Society from 1904 to

1911; six volumes were planned, but the work was hindered, first by a nervous illness of the younger West, which prevented his completing the necessary drawings, and then the war, so that only a preliminary draft or sketch was left, which may possibly be published as a memorial volume at a later date. Our own pages bear witness to their unceasing activity:—In our 'Transactions' appeared the "Freshwater Algæ of Madagascar" (1895), "North American Desmideæ" (1896), "Freshwater Algæ of Ceylon"—all papers of considerable length, illustrated by many plates, autotyped from the pen drawings of G. S. West. Our Journals contain from the latter, "Variation in Desmids" (1899), Tanganyika results (1907), "Critical Green Algæ" (1908), and "The Plankton of Yan Yean Reservoir" (1909). Shorter papers were printed in the 'Journal of Botany,' three at least, and others in the 'New Phytologist,' 'Journal of the Royal Microscopical Society,' and the 'Journal of the Quekett Microscopical Club.' He was responsible for the account of the freshwater algæ published in the volume edited by Mr. F. Morey in 1909, and with Mr. R. F. Griffith, an account of a giant sulphur bacterium named after his predecessor in the botanic chair at Birmingham, *Hillhousia*.

Two works on his special subject have been issued from the Cambridge University Press: the first, on British Freshwater Algæ, appeared in 1904; the other, on Algæ, simply was the first volume only, the second was to follow it.

Our late Fellow's influence in the University was great; he enjoyed the reputation of being one of the best lecturers at Birmingham, his clearness, conciseness, and admirable method in which he arranged the subjects of his lectures so as to enable his audience to grasp all salient points, and his blackboard diagrams, all joined in rendering his discourses memorable.

Besides his own duties, he served on many committees, including the Board of Agriculture and Fisheries for Staffs, Warwick, and Salop, and the Agricultural College, Studley. He was responsible for planning the grounds of the New University buildings at Bournbrook, Birmingham. He threw himself into the matter of re-afforestation, and personally inspected the plantations and old pit-banks.

His library of algological works and herbarium have been left to the University of Birmingham and his extensive series of drawings to the British Museum (Natural History).

The late Professor married in 1906, and leaves a widow and two children; he was elected a Fellow of the Linnean Society on the 4th April, 1901. [B. D. J.]

June 3rd, 1920.

Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The Minutes of the Anniversary Meeting of the 27th May, 1920, were read and confirmed.

The report of the Donations received since the last Meeting was laid before the Fellows, and the thanks of the Society to the several Donors were ordered.

Dr. Geoffrey Douglas Hale Carpenter, M.B.E., Miss Theodora Lisle Prankerd, B.Sc., Miss Lucy Ellen Cox, B.Sc., and Mr. Harry Bertram Harding were admitted Fellows.

Certificates in favour of the following were read for the second time:—Mr. William Harold Pearsall, M.Sc. (Manch.), Mr. Raymond Alfred Finlayson, Mr. Tom Russell Goddard, and Mr. William Henry Kitching.

Mr. Edmund Gustavus Bloomfield Meade-Waldo, Pyari Mohan Debbarman, B.Sc., Prof. Otto Vernon Darbishire, Ph.D., B.A. (Oxon.), Mr. William Rickatson Dykes, M.A. (Oxon), L.-ès-L. (Paris), Prof. Shankar Purushottam Agharkar, M.A. (Bombay), Ph.D., John Wishart, M.D., D.Sc., Ch.B., Mr. Howard Hamp Crane, Capt. Eric Fitch Daglish, R.F.A., Ph.D., Mr. Bertram Henry Buxton, and Prof. Otto Rosenheim, Ph.D., were elected Fellows.

The President read from the Chair the following proposed alterations in certain Bye-Laws:—

Chapter I. Sect. IV. *Delete* "successive" *in line* 3 *on* p. 16.

New Section to follow Chapter I. Sect V.:—

VI. Ballots for the Election of Fellows shall be held at one or more General Meetings of the Society in each Session. The date of such Ballots to be fixed by the Council, and at least one calendar month's notice to be given to every Fellow whose address is known. The Candidates shall be balloted for in the order in which their recommendations were received by the Secretaries, excepting that the Council may propose for Election out of their order and in preference to the others not more than four Candidates in any one year who are distinguished for their knowledge of the Science of Natural History. The Council shall decide as to the number of Ballots to take place at a Meeting, having regard to the number of vacancies at the time.

CHAPTER XVII. Sect. I. *To read*:—

Sect. I. In the printed Proceedings of the Society a record shall be annually made of all Donations of the amount or value of Twenty Pounds and upwards which have been made to the Society during the past twenty years.

The President also announced that he had appointed Mr. E. T. BROWNE, Prof. J. B. FARMER, F.R.S., Mr. HORACE W. MONCKTON, and Mr. R. I. POCOCK, F.R.S., Vice-Presidents.

It was announced from the Chair that Lady CRISP had offered the gift of an oil-painting by the late JAMES SANT, R.A., of the first admission of Women as Fellows of the Linnean Society, which the Council had accepted; it would remain a permanent reminder of an historic event.

A series of 50 water-colour drawings of the oil-palm, *Elaeis guineensis*, by Mr. R. SWAINSON HALL, F.L.S., were lent for exhibition by the Director of the Imperial Institute, Dr. Wyndham R. Dunstan, F.R.S. They were explained by Dr. A. B. Rendle, F.R.S., Sec.L.S.

This was followed by an exhibition by Mr. A. WHITEHEAD, B.Sc., of objects observed in the neighbourhood of Basra, during the war, with lantern-slides of the country and the people, which exhibition was communicated by Mr. H. Findon, F.L.S.

It gave rise to a discussion, in which Dr. A. B. Rendle, Mr. Lester-Garland, Dr. R. J. Tillyard, Prof. W. J. Dakin, and Miss Stephens took part, the exhibitor briefly replying.

Prof. W. J. DAKIN, F.L.S., showed a large series of photographs, as slides in the lantern, of Whaling in the Southern Ocean, giving a detailed description of the operations by a Norwegian association.

Mrs. Rose Haig Thomas, F.L.S., contributed further observations upon a former whaling station in the Hebrides.

June 17th, 1920.

Dr. A. SMITH WOODWARD, F.R.S., President, in the Chair.

The Minutes of the General Meeting of the 3rd June, 1920, were read and confirmed.

The report of the Donations received since the last Meeting was laid before the Fellows, and the thanks of the Society to the several Donors were ordered.

Mr. William Rickatson Dykes, M.A. (Oxon.), L. ès L. (Paris), Mr. Frederick John Freshwater Shaw, B.Sc., John Wishart, M.D., D.Sc., Ch.B., and Dr. Otto Rosenheim, were admitted Fellows.

Mr. George Peddie Miln, J.P., was proposed as a Fellow.

The certificate in favour of Mr. Chintaman Mahader Tembé, F.R.H.S., was read for the second time.

Mr. William Harold Pearsall, M.Sc. (Manch.), Mr. Raymond Alfred Finlayson, Mr. Tom Russell Goddard, and Mr. William Henry Kitching, were elected Fellows.

The President read the proposed alterations in the Bye-Laws Chapters I. and XVII. for the second time.

The following communications in commemoration of Sir Joseph Banks, Bart., P.R.S., the centenary of whose death falls upon the 19th June, 1920, were read as follows :—

1. The General Secretary.—Banks as a Traveller.
2. Dr. A. B. Rendle, F.R.S., Sec.L.S.—Banks as a Patron of Science.
3. Mr. James Britten.—Banks as a Botanist.
4. The President.—Banks as a Trustee of the British Museum of paramount power.

Dr. D. H. Scott, F.R.S., Sir Henry Howarth, F.R.S. (visitor), and Mr. Britten engaged in a discussion on some of the points raised. (See Supplement.)

The communications were supplemented by the exhibition of the following Banksiana :—

Shown by the Society: Letters, books published or patronised by him; an original water-colour drawing, inscribed "The inside of an Iceland House occupied by Sr Joseph Banks during his residence on the Island with several of its Inhabitants, with Sr Jos. Banks & Dr. Solander in the dress they wore drawn in the Island 1772."

Lent by the Royal Society: A framed caricature of Sir Joseph Banks, with a monstrous fungus developed in his cellar.

Lent by Mr. G. W. E. Loder: engraving by J. R. Smith after the portrait painted by Benjamin West, of Banks in a Tahitan cloak.

Lent by Mr. G. W. E. Loder: Mezzotint by Wm. Dickinson after the portrait painted by Joshua Reynolds: with the Horatian

line, *Cras ingens iterabimus aequor*, which gives colour to the belief that this was painted before the failure of the plan to embark on the 'Resolution' in 1772.

[The Society also possesses a holograph of Banks prepared by him as "Hints on the subject of Gardening suggested to the gentlemen who attend the Embassy to China" for Lord Macartney's Embassy in 1792, which was given to the Society in 1823, with a covering letter from Sir George Staunton, stating that it was found amongst the papers of the Embassy.]

June 24th, 1920.

Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The Minutes of the General Meeting of the 17th June, 1920, were read and confirmed.

The report of the Donations received since the last Meeting was laid before the Fellows, and the thanks of the Society to the several Donors were ordered.

Dr. Robin John Tillyard, Mr. James Hornell, and Mr. Walter John Dowson, M.A. (Cantab.), were admitted Fellows.

Mr. Henry Baker Lacey and Miss Ethel Spratt, D.Sc. (Lond.), were proposed as Fellows.

Mr. Chintaman Mahader Tembé was elected a Fellow.

The proposed alterations in the Bye-Laws, which had been read from the Chair on the 3rd and 17th June last, were submitted to a ballot by the Fellows present and adopted.

The General Secretary read a letter received from the Swedish Linnean Society regarding the proposed restoration of the old Botanic Garden at Uppsala with the house in it formerly occupied by Carl von Linné. As the Society is debarred by its Charters from making a direct grant to this praiseworthy object, it can only be effected by private effort, and notwithstanding the numerous demands made at the present time, it is hoped that substantial assistance towards realising this memorial to our eponymous hero will be forthcoming.

Dr. Karl J. F. Skottsberg, Director of the Göteborg Botanic Garden, and leader of the Swedish Expedition to Patagonia and

Tierra del Fuego in 1907–09, then gave a lecture on the "Botanical Features of the Juan Fernandez group of islands," and by the help of 70 lantern-slides from photographs taken by himself, gave a graphic account of the flora of the two principal islands, Masatierra and Masafuera, and of a visit to the islet Santa Clara. The views gave a vivid presentation of the extraordinary forms assumed by the water-worn rocks, now existing as ridges between deep cañons.

The President commented on the extreme interest and value of the observations made by Dr. and Mrs. Skottsberg during their six months' stay in the group.

Dr. R. J. Tillyard, F.L.S., then delivered a short lecture on the new Cawthron Institute, of which he has just been appointed Chief of the Biological Department. He stated that the Institute is to be situated in the city of Nelson, N.Z., where the founder, Thomas Cawthron, lived for most of his life. The lecturer gave an account of the early life and adventures of the founder, and showed how he rose from a low estate to become a very wealthy man. In his later years he busied himself with philanthropic enterprises, and on his death it was found that he had left the greater portion of his fortune for the purpose of founding an institute of scientific research. After all claims had been paid, the Cawthron Trust was left with a capital of about £200,000 which, wisely invested, yields an income of about £11,000 a year. Prof. T. H. Easterfield, of Wellington, a chemist of wide repute, has been appointed Director and Chief of the Chemical Department, with Mr. T. H. Rigg, late of Rothampsted, working under him as Agricultural Chemist. In the Biological Department, Miss K. M. Curtis has been appointed Mycologist and Mr. A. Philpott, F.E.S., Assistant Entomologist. The Library and Museum are under the care of the Curator, Mr. W. C. Davies. The activities of the Institute will be directed towards scientific research, both pure and applied, with a view to benefiting the primary industries of New Zealand as a whole and of the Nelson Province in particular.

ABSTRACTS.

Notes on the Life-history of *Iris Pseudacorus*, Linn., with special reference to its Seeds and Seedlings. (With 1 text-figure.)

By Thomas Alfred Dymes, F.L.S.

[Read 19th June, 1919.]

On 30th November, 1916, I communicated to the Society a note on the seed of *Iris Pseudacorus*, Linn., in which I drew attention to its germination while still afloat, and the difficulty I had experienced in raising seedlings in the open, either on or in mud. On 1st November, 1917, Lt.-Col. J. H. Tull Walsh, I.M.S., F.L.S., communicated the results of his experiments, and exhibited healthy seedlings raised from seeds on or in mud in the open. In 1918 I made a great many experiments to discover why I had failed. That failure was due to too low a temperature, for I kept my mud sowings in cool shade, whereas a comparatively high temperature is necessary for the successful germination of the seeds during their first season. The present communication summarises very briefly the results of these and earlier experiments and observations from 1913 onwards. I need only add that in favourable years, of which 1918 was one, the temperature of the mud and shallows, in which the seeds of this species germinate normally in May and June, frequently rises many degrees above 70° F. during the day, without falling appreciably below it during the night, and for a period sufficiently long to ensure successful germination; that in my cool shade experiments it was generally nearer 60° F., that it never rose as high as 65° F., and that not a single seed produced a seedling, whereas in the higher temperature I was at the same time recording very satisfactory results from a large number of separate sowings under various conditions.

Iris Pseudacorus, Linn., is distributed in abundance throughout the British Isles, ascending from sea-level to about 700 feet. Its xerophytic adaptations protect it from some of the dangers of its environment. Protection from animals is afforded by its acrid and astringent secretions, but it is attacked by the larvæ of various insects and molluscs. Domestic ducks eat the seeds and the very young seedlings, and it is almost certain that wild-fowl do so too. *Puccinia Iridis*, DC., is recorded as a fungal foe, and floating seedlings which have failed to strike root sink in the autumn and perish from disease during the winter. An immense amount of observation on the natural enemies has, however, still to be made and is very much to be desired.

In some years, when February is hot and sunny, germination commences in that month, but in others, when the season is cold and dull, not until mid-June; the normal minimum period in nature, commencing in September, when the capsules begin to dehisce, is therefore from five to nine months, according to the season, and usually about seven; the maximum is certainly not

less than twenty. Vegetative propagation is effected by the rhizomes. Plants which I raised in 1916 from floating seedlings, the offspring of seeds harvested in 1915, flowered for the first time in June 1919, at the commencement of their fourth year.

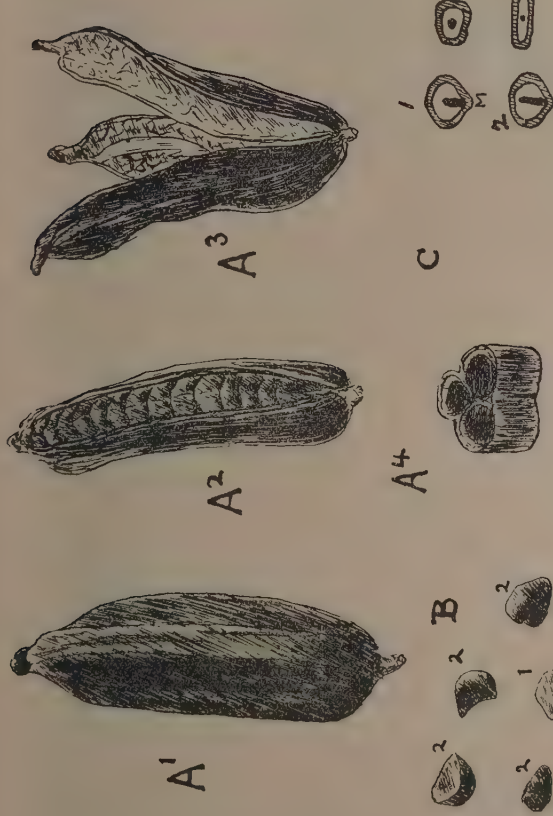
The seeds number from forty or less, to sixty or more, per capsule, and there are sometimes as many as nine good capsules on a spathe. Before maturity the seeds are white and saturated throughout with moisture; the capsule begins to dehisce before the end of September; and then the dry brown testa of the ripe seed is glazed externally, but not internally, and the kernel, which consists of the inner integument, the horny endosperm, and the straight embryo, lies loose within it.

The seeds are carried long distances overland by diving birds, which are the most important of all the dispersal agents, and I think it quite probable that the altitudinal range in this country is dependent to some extent upon that of the birds that disperse the seeds. The floating seedlings get entangled in the legs of domestic ducks, and are almost certainly dispersed in this way by our native swimming birds. The wind is the least important of the dispersal agents. When the ground around permits, it extends the area of an existing colony outward, but dispersal by the wind alone is practically confined to its blowing the flat seeds a few yards away from the parent plant. In conjunction with dead leaves, however, it is responsible for a good deal of wider, but still local dispersal, and in conjunction with water it blows the floating seeds from one end of a lake or pond to the other. Seeds which have been ice-borne germinate freely, and bits of floating rhizome help to disperse the species since, when stranded on freshwater mud, they reproduce the plants vegetatively. The flat seeds are adapted to dispersal (1) on the backs of diving birds, to which they adhere as the diver rises from below to the surface upon which they are afloat, and (2) by being blown short distances by the wind. In the first event they are useful for founding fresh colonies, often at a great distance, and in the second for extending the area of one already existing. The round seeds, numerically only about one to four of the flat, serve to fill up the death gaps at home and along the margins of running waters.

Sunk seeds possess, while floaters are without, an internal supply of water between the testa and the kernel, which causes them to sink. They yield slightly higher percentages of germination than the floaters. In experimenting, however, one has to make quite sure that the seeds have sunk for this reason, and not merely because of the weight of their superincumbent accretions. Intermittent drought reduces the percentage, and dessiccation during the autumn and winter inhibits it almost completely for the first season, except when damage to the testa has let in water to soften the hardened and shrunken endosperm before it is too late.

Dealing for the moment only with first-year seeds—those that are less than a year old—those which are on or at the bottom of shallow water and those which are in, not on, saturated mud,

exposed in either case to hot sunshine, fare the best. The highest percentages of germinations are yielded by floaters and sinkers on or in water one to four inches deep. At greater depths the percentages decrease steadily until at seven inches or more the seedlings produced by sinkers, if any, do not survive; at nine inches none were procured in my experiments.



A. *Capsules.*—1. Immature. 2. Dehiscing. 3. Spent. 4. In section, to show a single row of seeds in each loculus.
B. *Seeds, whole.*—1. Flat. 2. Round.
C. *Seeds in section, diagrammatic.*—1 and 2. Embryo in longitudinal section, M=micropyle. 3 and 4. Embryo in cross section. 1. Embryo before germination. 2. Embryo after plumular germination, but before the extrusion of the radicle. 3. Flat seed with thin anterior and posterior layers of endosperm. 4. Round seed to show the greater thickness of the same layers. All seven-eighths natural size.

The round floaters germinate more slowly, and yield a lower percentage than the flat floaters, possibly on account of the greater difficulty of plumular irrigation, since in the round the embryo is surrounded on all sides by a thick layer of horny endosperm, whereas in the flat there is hardly any either anteriorly or posteriorly (see text-figure). The round floaters commonly

germinate in a week or more after the flat ones, but with sunk seeds I could detect no such difference, presumably because the internal water-supply had saturated the whole endosperm before the arrival of the time for germination.

Seeds in their second year gave the same general average as those in their first, namely 20 per cent.: thus, taking two years together, 36 seedlings would be the total average yield of every hundred seeds of the harvest of any given year, but more evidence is desirable anent second-year germination. Third-year germination is in all probability never accomplished successfully. I have on several occasions raised sickly weaklings, but none of them have ever lived through the autumn.

Seedlings from seeds which germinated while still afloat among other flotsam can be distinguished readily from those born in mud by possessing a long, branched chlorophyllous radicle, as well as curved and hooked adventitious roots. Securing adequate anchorage is their chief difficulty, which, however, does not trouble the mud seedling, whose seed is buried before germination, especially as the hypogeal cotyledon remains in the endosperm and the hypocotyl is not developed. Seeds in mud, either under water or not, owe their burial to a covering of dead leaves or debris and also to being trodden in by birds and mammals, and it is worth remembering in this connection that dispersal in dead leaves has thus great advantage for the seedling, that worms are always dragging them underground and so burying and anchoring in the soil the seeds that they contain. The radicle being poor in root-hairs, naked seeds or mud without any overlying water fail or succeed according to its hardness. Those on mud under water constantly perish because of its extreme softness, especially when the depth of the water exceeds a few inches; on the other hand, whether under water or not, they are frequently held down by an overlay of debris, and are therefore able to strike root.

The floater is exposed to many and great dangers. It may be carried out to sea only to perish, and if it be solitary upon fresh water clear of debris it is probably doomed; it lies flat, is unable to erect itself or take root, and perishes. If, however, it drifts on to mud it will root readily enough. Floating together or in debris the seedlings erect themselves by the action of the hooked adventitious roots. In my experiments the four or five adventitious roots of the solitary floater did not become either curved or hooked, suggesting that this condition is a useful response to the stimulus of contact. It is interesting to note that the floating seedling, sunk subsequently under 7 inches of water, succeeded, whereas the offspring of seeds sown at the same depth perished.

The height attained by seedlings from first-year seeds, during their first season up to Christmas, varies from 2 inches in leaf-measurement for the unanchored solitary flat floater to 13 inches in saturated mud; but seedlings from seeds in their second year, sown in saturated mud, produced leaves 19 to 19½ inches long.

It was under conditions which prevail more or less completely at the margins of streams and recently colonised sheets of water that I obtained my highest records of germination, and that is probably Nature's provision against the extreme risks to which the offspring are there exposed.

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Plant-sports produced at will.

By Col. H. E. Rawson, C.B., R.E., F.L.S.

[Read 6th November, 1919.]

The observation that shrubs of Kei-apple (*Aberia caffra*) near Cape Town died when they were deprived of full sun up to a certain altitude in the early morning, led to experiments in screening vegetables at this hour for various periods. The results obtained suggested a system of screening plants at selected intervals of daylight, to which the term "selective screening" was applied. A new variety of *Tropæolum majus* appeared in consequence, and re-appeared amongst the seedlings in following years which were similarly screened, eventually becoming fixed.

Well-known sports began to appear in *Tropæolum* plants, such as an increased number of spurs, proliferation, and leaf-division, which also reappeared when the same selective screening was adhered to.

These sports and several new varieties of *T. majus*, as well as many correlated variations, re-appeared in the open garden without selected screening.

The experiments were extended, and a new single form of *Papaver Rhœas* which was desired was obtained. From this single Poppy a double form appeared which has become fixed.

Sterility was very marked in all cases of sudden changes of colour or structure, indicating that the reproductive organs were affected by selective screening. Proliferation and the transmission through the seed of the changes in colour and structure also point to the organs being influenced during, as well as subsequent to, the action upon the *soma*; while leaf-division, increased spurs, and the correlated variations therewith, prove that the *soma* of the plant has been affected generally by the screening. The intensity of the light regulates and modifies the coloured bands upon all parts of a plant which have been excited by interference.

In nature, selective screening prevails very universally, and these experiments suggest that it deserves to be studied for its power to bring out potentialities which are known to be latent, and to cause correlated variations. Insect-visitors give rise to coloured bands.

Recent American research (**5**) gives support to the views set out in this abstract.

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The Marsh and Spotted Orchids.

[Read 6th May, 1920.]

Mr. E. J. Bedford exhibited a series of 30 water colour drawings, natural size, of the Marsh and Spotted Orchids and their varieties. These were accompanied by a number of detail drawings showing the lips, pollinia, etc. The forms shown included *Orchis incarnata*, L., from Hampshire and West Sussex, with the salmon-pink or flesh-coloured flowers; also a pale pink form with only the slightest trace of markings on the lip: this came from a Middlesex locality.

A form with dull purple flowers and broad lip, leaves bright green and unspotted. This has been known by some botanists as *O. incarnata*, by others as *O. latifolia*, and has recently been named *O. prætermissa* by Dr. G. C. Druce. Specimens of this variety were shown from Middlesex and East Sussex.

Also a form (*O. incarnata*?) with crimson-coloured flowers from Westmorland, and two other varieties from the same locality with similar colouring but wider and flatter lips, sent to the writer as *O. incarnata* var. *pulchella*, Druce.

The Spotted Orchid was represented by three distinct forms. The first, a vigorous plant with dark green heavily spotted leaves, the labellum having a small and narrow centre division and wide side ones; this variety has recently been referred to as *O. maculata*, L., and is usually found in damp situations on heaths or marshes on sandy soils. The second form had similar foliage to the first, but the labellum divided into three equal lobes with the longest in the centre. This is known as var. *trilobata* on the Continent, and has been named *O. Fuchsii* by Dr. Druce.

The third form was that known as *O. ericetorum*, Linton, a much less vigorous plant than either of the others, with narrow leaves, and found usually in exposed situations on heaths and sandy soils, often at considerable elevations. All these forms of the Spotted Orchid are from East Sussex.

The following hybrids were shown: *O. incarnata* × *prætermissa*, *O. prætermissa* × *incarnata*, *O. prætermissa* × *Fuchsii*. In the detailed drawings of the lip the examples shown testified to the enormous difference of form and markings assumed by each species, even in those gathered at one time from the same restricted locality. The various forms were also shown by a series of 70 lantern-slides upon the screen, each variety being represented *in situ*; (2) on a larger scale, and (3) enlarged front and side views of the labellum.

BENEFACTIONS.

LIST *in accordance with Bye-Laws, Chap.* XVII. *Sect.* 1, *of all Donations of the amount or value of Twenty pounds and upwards, received during the past Twenty years.*

1901.

Hon. Charles Ellis, Hon. Walter Rothschild, Frank Crisp, Esq., F. D. Godman, Esq., and the Bentham Trustees: The Correspondence of William Swainson.

Royal Society: Contribution towards Mr. F. Chapman's paper on Funafuti Foraminifera, £50.

Prof. E. Ray Lankester: Contribution towards illustration, £30 5*s*.

Portrait of Dr. St. G. J. Mivart, presented by Mrs. Mivart.

1903.

Royal Society: Contribution toward Dr. Elliot Smith's paper, £50.

Legacy from the late Dr. R. C. A. Prior, £100 free of duty.

Mrs. Sladen: Posthumous Portrait of the late Walter Percy Sladen, by H. T. Wells, R.A.

B. Arthur Bensley, Esq.: Contribution to his paper, £44.

1904.

Royal Society: Grant in aid of third volume of the Chinese Flora, £120.

Frank Crisp, Esq. (afterwards Sir Frank Crisp, Bt.): Cost of Supplementary Royal Charter.

The same: Bulliard (P.). Herbier de la France; Dictionnaire; Histoire des plantes vénéneuses; Champignons, in 10 vols. Paris, 1780–1812.

1905.

Royal Society: First grant in aid of Dr. G. H. Fowler's 'Biscayan Plankton,' £50.

Executors of the late G. B. Buckton, Esq.: Contribution for colouring plates of his paper, £26.

1906.

Royal Society: Second grant towards 'Biscayan Plankton,' £50.

Subscription portrait of Prof. S. H. Vines, by Hon. John Collier.

Royal Swedish Academy of Science: Copies of portraits of C. von Linné, after Per Krafft the elder, and A. Roslin, both by Jean Haagen.

1907.

Royal University of Uppsala: Copy by Jean Haagen of portrait of C. v. Linné, by J. H. Scheffel (1739).

Royal Society: Third and final grant towards 'Biscayan Plankton,' £50.

The Trustees of the Percy Sladen Memorial Fund: First grant towards publication of Mr. Stanley Gardiner's Researches in the Indian Ocean in H.M.S. 'Sealark,' £200.

1908.

Prof. Gustaf Retzius: Plaster cast of bust of Carl von Linné, modelled by Walther Runeberg from the portrait by Scheffel (1739) at Linnés Hammarby: the bronze original designed for the façade of the new building for the Royal Academy of Science, Stockholm.

Miss Sarah Marianne Silver (afterwards Mrs. Sinclair), F.L.S.: Cabinet formerly belonging to Mr. S. W. Silver, F.L.S.

1909.

The Trustees of the Percy Sladen Memorial Fund: Second grant towards publication of Mr. Stanley Gardiner's Researches in the Indian Ocean in H.M.S. 'Sealark,' £200.

Prof. James William Helenus Trail, F.R.S., F.L.S.: Gift of £100 in Trust, to encourage Research on the Nature of Protoplasm.

1910.

Royal Society: Grant towards Dr. G. H. Fowler's paper on Biscayan Ostracoda, £50.

Sir Joseph Hooker: Gold watch-chain worn by Robert Brown, and seal with portrait of Carl von Linné by Tassie.

Prof. J. S. Gardiner: Payment in aid of illustrations, £35 0*s.* 6*d.*

Sir Frank Crisp: Donation in Trust for Microscopical Research, £200.

The Trustees of the Percy Sladen Memorial Fund: Third grant towards publication of Prof. Stanley Gardiner's Researches in the Indian Ocean, £200. (For third volume.)

1911.

The Trustees of the Percy Sladen Memorial Fund: Second Donation towards the publication of the third volume on the Indian Ocean Researches, £70.

The same: First Donation towards the fourth volume, £130.

1912.

The Indian Government: Contribution towards the illustration of Mr. E. P. Stebbing's paper on Himalayan *Chermes*, £46 15*s.* 2*d.*

The late Mr. Francis Tagart, £500 free of Legacy Duty.

The late Sir Joseph Dalton Hooker, O.M., G.C.S.I., £100 free of Legacy Duty.

The Trustees of the Percy Sladen Memorial Fund: Second Donation towards the publication of the fourth volume on the Indian Ocean Researches, £140.

The same: First Donation towards the fifth volume, £60.

1913.

Royal Society: Grant towards Dr. R. R. Gates's paper on Mutating Oenotheras, £60.

Sir Frank Crisp, Bt., Wallichian Cabinets, £50.

The Trustees of the Percy Sladen Memorial Fund: Second Donation towards the publication of the fifth volume, £200.

1914.

Royal Society: Grant towards Miss Gibbs's paper on the Flora of British North Borneo, £50.

Miss Foot: Cost of illustration of her paper on *Euschistus*.

The Trustees of the Percy Sladen Memorial Fund: Third Donation towards the fifth volume, £10.

The same: First Donation towards the sixth volume, £190.

1915.

The Trustees of the Percy Sladen Memorial Fund: Second Donation towards the sixth volume, £80.

Miss Foot: Cost of second paper on *Euschistus*, £32 10*s.*

Royal Society: Donations towards the cost of a paper by Mrs. Arber, D.Sc., £40.

The same: towards paper on Utakwa River plants by Mr. H. N. Ridley, C.M.G., F.R.S., £50.

Miss Marietta Pallis: Instalment of cost of her paper on Plav, £30.

Thomas Henry Riches, Esq.: Dr. A. R. Wallace's library on Natural History.

Sir Frank Crisp, Bt.: New shelving for Wallace's Volumes.

1916.

Mr. E. Heron-Allen: Contribution to cost of paper on Foraminifera of N.W. Scotland, £44.

Messrs. H. Takeda and C. West: Contribution towards the illustration of their paper, £40.

Royal Society: Contribution towards the illustration of two papers by Prof. Dendy, £40.

The same: Contribution towards Mr. Swynnerton's paper on Form and Colouring, £70.

The High Commission for the Union of South Africa, per Dr. J. D. F. Gilchrist, for the illustration of his paper on *Jasus Lalandii*, £30.

Miss Marietta Pallis: Balance of cost of her paper on Plav, £90 16*s.* 6*d.*

Sir Frank Crisp, Bt.: Phototyped copy of Dioscorides from the 'Codex Aniciæ Julianæ' at Vienna.

1917.

British Ornithologists' Union, etc.: Contribution towards cost of Mr. H. N. Ridley's paper, £20.

The Royal Society: Second contribution towards the printing of Mr. C. F. M. Swynnerton's paper on Form and Colouring, £75.

Sir Frank Crisp, Bt.: 'Lindenia,' Ghent, 1891–1901. 17 vols. sm. fol.

1919.

Dr. B. Daydon Jackson: MS. index to Linnean Society's Journal, Botany, vols. xxi.–xl. (1884–1912) and the Botanic entries in the 'Proceedings' for the same period.

1920.

The Royal Society: Third contribution towards the printing of Mr. C. F. M. Swynnerton's paper as above, £50.

The High Commission for the Union of South Africa, for the printing of Dr. J. D. F. Gilchrist's paper on *Jasus Lalandii*, Part II., £60.

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—— *See* **Kennard (A. S.).**

INDEX TO THE PROCEEDINGS.

SESSION 1919–1920.

Note.—The following are not indexed:—The name of the Chairman at each meeting; speakers whose remarks are not reported; and passing allusions.

Abstracts of Papers, 59–65.
Accounts, 22–24.
Additions to Library, 71–79.
Adkin, B. C., admitted, 5; elected, 3; sec. reading, 1.
'Admission of women as Fellows,' painting by Sant, presented by Lady Crisp, 55.
Agharkar, Dr. S. P., elected, 54; proposed, 13; sec. reading, 18.
Ajuga genevensis, occurrence in Britain (Druce), 3–4.
Allen, *see* Heron-Allen.
Anniversary Meeting, 19.
Aplin, O. V., withdrawn, 20.
Ascroft, R. W., withdrawn, 20.
Associate, E. W. Swanton, elected, 17; proposed, 13.
Auditors elected, 18.
Axolotls exhibited (Huxley), 12.

Baker, E. G., elected Councillor, 20.
Baker, E. G., S. Moore, and Dr. A. B. Rendle, Flowering plants of New Caledonia, 14–15.
Banks (Sir Joseph) Celebration:—Banks as a traveller (Gen. Sec.); Banks as a patron of science (Rendle); Banks as a botanist (Britten); and Banks as a trustee of the British Museum (The President), 56; *Suppl.*, pp. 1–21.
Banksiana exhibited, 56.
Baphia, Afzel., revision of (Lester-Garland), 2.
Basra, lantern-slides of objects obs. near, shown (Whitehead), 55.
Bateson, Dr. W., Councillor retired, 21.
Bedford, E. J., exhibited illustrations of British Marsh Orchids, 18; abstract, 65.
Benefactions, 66–69.
Benson, Prof. M. J., elected Councillor, 20.
Bhan, T. N., elected, 10; proposed, 1; sec. reading, 6.
Bidder, Dr. G. P., admitted, 5; elected, 3; sec. reading, 1; Fragrance of Calcinean Sponges; *Syncrypta spongiarum*; and Notes on physiology of Sponges, 18.
Billinghurst, H. G., admitted, 2.
Blackman, Prof. V. H., admitted, 15.
Blathwayt, Col. L., deceased, 19; obituary, 37.
Bodger, J. W., proposed, 18.
Bonnier, Prof. G., elected For. Memb., 18; proposed, 13.
Bose, S. R., elected, 10; proposed, 1; sec. reading, 6.
Botanic Illustration during four centuries (Gen. Sec.), 7–9.
'Botanical Magazine,' first numbers in orig. wrappers, exhibited (Loder), 14.
Botanical Secretary (Dr. A. B. Rendle), elected, 21; appeal for purchase of Cardot's Herbarium of Mosses, 7; on Botany of New Caledonia, 14–15.
Boulenger, Dr. G. A., proposed, 5.
British Marsh Orchids, drawings, &c. exhibited (Bedford), 18; abstract, 65.
Brotherus, Prof. V. F., elected For. Memb., 18; proposed, 13.
Browne, E. T., appointed V.-P., 55; elected Auditor, 18; elected Councillor, 20.

Burma, exploration of N. E. frontier (Ward), 17.
Burne, R. H., Councillor retired, 21.
Bury, H., elected Councillor, 20.
Buxton, B. H., elected, 54; proposed, 13; sec. reading, 18.
Bye-Laws, proposed alterations read, 2, 3, 11, 13, 54, 56; adopted, 6, 15–16, 57; statement read (Dymes), 13; motion by Prof. Weiss, 16.

Calcinean sponges, *see* Sponges.
Cardot, J., appeal for purchase of his Herbarium of Mosses, 7.
Carpenter, Dr. G. D. H., admitted, 54; elected, 15; proposed, 2; sec. reading, 13.
Carter, Dr. N., Freshwater Algæ of New Caledonia, 14.
Cash Statement received and adopted, 19; printed as audited, 22–24.
Cavanagh, B. F., withdrawn, 20.
Cawthron Institute, Dr. R. Tillyard on, 58.
Centaurium scilloides, occurrence in Britain (Druce), 3–4.
Characters in Organisms, different types (Gates), 10–11.
Composition Fees, privilege suspended, 2.
Compton, Prof. R. H., *and others*, Botany of New Caledonia, 14.
Contribution, Annual, raised to four pounds, 11.
Cooper, *see* Omer-Cooper.
Councillors elected and retired, 20–21.
Cox, Miss L. E., admitted, 54; elected, 18; proposed, 3; sec. reading, 17.
Craib, W. G., elected, 17; proposed, 2; sec. reading, 15.
Crane, H. H., elected, 54; proposed, 13; sec. reading, 18.
Crisp, Lady, withdrawn, 20; gift of painting of the first admission of women as Fellows, 55.

Daglish, Capt. E. F., elected, 54; proposed, 13; sec. reading, 18.
Dakin, Prof. W. J., showed lantern-slides of Whaling in the Southern Ocean, 55.
Darbishire, Dr. O. V., elected, 54; proposed, 13; sec. reading, 18.
Dastur, R. H., proposed, 18.
Davidson, Dr. James, admitted, 15; elected, 7; proposed, 1; sec. reading, 5.
Deaths recorded, 19.
Debbarman, P. M., elected, 54; proposed, 6; sec. reading, 18.
Denham, H. J., elected, 3; sec. reading, 1.
De Toni, Prof. G. B., elected For. Memb., 18: proposed, 13.
Dod, *see* Wolley-Dod.
Dollo, Prof. L., elected For Memb. 18; proposed, 13.
Dowson, W. J., admitted, 57.
Druce, Dr. G. C., occurr. in Britain of *Ajuga genevensis* and *Centaurium scilloides*, 3–4; exhibited drawings of British *Rubi* by Miss Trower, 4.
Druce, H. H. C. J., withdrawn, 20.
Dykes, W. R., admitted, 56; elected, 54; proposed, 10; sec. reading, 18.
Dymes, T. A., appointed Scrutineer, 20–21; elected Auditor, 18; Notes on *Iris Pseudacorus*, 59–63.

Eastham, A., removed from List, 20.
Edwards, S., elected Auditor, 18; elected Councillor, 20.
Elaeis guineensis, drawings by R. S. Hall exhibited, 55.
Elections reported, 20.
Entomological-Meteorological records exhibited (Gunton), 12.
Evernia Prunastri, Ach., lantern-slides of sporulation of gonidia in (Paulson), 17.

Farlow, Prof. W. G., death announced, 9, 19; obituary, 38.
Farmer, Prof. J. B., appointed V.-P., 55; elected Councillor, 20; Hepatics of New Caledonia, 14.
Findon, H., gift of Kirkman's 'British Bird Book,' 5.
Finlayson, R. A., elected, 56; proposed, 16; sec. reading, 54.
Flanagan, H. G., deceased, 19.
Foreign Members, deaths reported, 19; vacancies announced, 9, 11; six new elections, 18.

Gardner-Smith, Rev. R., withdrawn, 20.
Garland, *see* Lester-Garland.
Gatenby, J. B., Germ-cells and early development of *Grantia compressa*, 6.
Gates, Dr. R. R., Two fundamentally different types of characters in organisms, 10–11.
Geffcken, A. W., withdrawn, 20.

General Secretary, Annual Report, 19; elected (Dr. B. D. Jackson), 21; completion of 40 years as Secretary, 37; exhibited the first numbers of the 'Bot. Mag.' in original wrappers, 14; on a new ed. of the Library Catalogue, 19; methods of Botanic Illustration during four centuries, 7–9; on proposed restoration of Carl von Linné's house at Uppsala, 57; Sir Joseph Banks as a Traveller, *Suppl.*, 3–8.
Geotropic response in roots and stems (Small), 16.
Gepp, A., Maritime Algæ of New Caledonia, 14.
Gibson, Ernest, deceased, 19.
Goddard, T. R., elected, 56; proposed, 16; sec. reading, 54.
Goodday, A. L., admitted, 18; elected, 15; proposed, 2; sec. reading, 13.
Goodenough Fund, announcement made, 7; list of donations, 70.
Goodrich, Prof. E. S., elected Zoological Secretary and Councillor, 20–21.
Grantia compressa, germ-cells and early development (Gatenby), 6.
Groves, J., Characeæ of New Caledonia, 14.
Gunton, Major H. C., exhibited Entomological-Meteorological records, 12.
Gwynne-Vaughan, Dame Helen, received Trail Award and Medal, 35.

Haeckel, Prof. Ernst H., death announced, 9, 19; obituary, 39.
Hall, R. S, drawings of the oil-palm, *Elaeis guineensis*, exhibited, 55.
Hamilton, A., removed from List, 20.
Harde, Mrs. E. E., elected, 18; proposed, 5; sec. reading, 17.
Harding, H. B., admitted 54; elected, 18; proposed, 5; sec. reading, 17.
Herdman, Prof. W. A., Notes on the abundance of Marine Animals, 6.
Heron-Allen, E., admitted, 15.
Hicks, F., deceased, 19.
Hill, Capt. A. W., elected Councillor, 20.
Hirst, A. S., elected, 15; proposed, 2; sec. reading, 13.
Hogben, L., Nuclear phenomena in the oocytes of *Neuroterus*, 2.
Hogg, S., admitted, 5.
Hole, R. S., admitted, 2.
Hopkinson, J., deceased, 19; obituary, 43–45.
Hornell, J., admitted, 57.
Huskisson, H. O., deceased, 19.
Huxley, J. S., and D. F. Leney, exhibited Axolotls, 12.

India, Southern, plants exhibited (Patton), 3.
Institute of Preventive Medicine, gift of volumes on Sponges, 6.
Iris Pseudacorus, Notes on (Dymes), 59–63.
Irwin-Smith, Miss V. A., elected, 3 sec. reading, 1.
Iyer, V. S., deceased, 19.

Jackson, Dr. B. D., elected Councillor, 20; and General Secretary, 21.
Johnson, W. H., withdrawn, 20.
Juan Fernandez group, Botanical features (Skottsberg), 57–58.

Kirkman's 'British Bird Book' presented (Findon), 5.
Kitching, W. H., elected, 56; proposed, 18; sec. reading, 54.
Knight, A. E., withdrawn, 20.

Lacaita, C. C., elected Councillor, 20; exhibited *Orchis maculata* from Monte Gargano, Italy, 3.
Lacey, H. B., proposed, 57.
Lancaster, *see* Percy-Lancaster.
Lankester, Sir E. Ray, Linnean Medal presented to, 35; his reply, 36–37.
Leeson, Dr. J. R., on need of a new Library Catalogue, 19.
Leney, D. F., *see* Huxley, J. S.
Lester-Garland, L. V., a revision of the genus *Baphia*, Afzel., 2.
Librarian's Report, 20.
Library, Additions and Donations, 71–79.
Library Catalogue, new edition needed, 19.
Linné, Carl von, proposed restoration of his house at Uppsala, 57.
Lister, Miss G., Mycetozoa of New Caledonia, 14–15.
Loder, G. W. E., elected Councillor, 20; first numbers of the 'Bot. Mag.' in orig. wrappers exhibited, 14.
Lowne, B. T., withdrawn, 20.

McLean, Prof. R., admitted, 2; Sex and Soma, 4–5.
Marchal, Prof. P., elected For. Memb., 18; proposed, 13.
Marine Animals, notes on the abundance of (Herdman), 6.

Marshall, Rev. E. S., deceased, 19; obituary, 45.
Mathews, G. M., withdrawn, 20.
Matthews, J. R., admitted, 6; elected, 3; sec. reading, 1.
Meade-Waldo, E. G. B., elected, 54; proposed, 5; sec. reading, 18.
Medal, Linnean, presented to Sir E. Ray Lankester, 35–37; — Trail, presented to Dame Helen Gwynne-Vaughan, 35.
Mesopotamian plants exhibited (Patton), 3.
Michael, A. D., withdrawn, 20.
Miln, G. P., proposed, 56.
Minchin, Prof. E. A., volumes on Sponges formerly his, presented by Inst. Prevent. Med., 6.
Mockeridge, Miss F. A., admitted, 1.
Monckton, H. W., appointed V.-P., 55; elected Councillor and Treasurer, 20–21.
Monte Gargano, *Orchis maculata* from, exhibited (Lacaita), 3,
Moore, Spencer. *see* Baker, E. G.
Morgan, A. C. F., withdrawn, 20.
Mosses, Cardot's Herbarium of, appeal for its purchase, 7.

Neuroterus, nuclear phenomena in the oocytes of (Hogben), 2.
New Caledonia, Botany of (Compton and others), 14.
Nuclear phenomena in the oocytes of *Neuroterus* (Hogben), 2.

Obituary Notices, 37–53.
Omer-Cooper, J., elected, 18; proposed, 3; sec. reading, 17.
Orchids, British Marsh, illustrations exhibited (Bedford), 18; abstract, 65.
Orchis maculata from Monte Gargano exhibited (Lacaita), 3.
Organisms, types of characters in (Gates), 10–11.

Pannikar, N. P., elected, 5; proposed, 1; sec. reading, 3.
Parker, Dr. W. R., admitted, 13; elected, 10; proposed, 1; sec. reading, 6.
Patton, T. K., exhibited plants from Mesopotamia and Southern India, 3.
Paulson, R., elected Auditor, 18; lantern-slides of sporulation of gonidia in *Evernia Prunastri*, Ach., 17.
Pearsall, W. H., elected, 56; proposed, 15; sec. reading, 54.
Peckover, Baron, of Wisbech, deceased, 19; obituary, 46.
Percy-Lancaster, S., elected, 18; proposed, 2; sec. reading, 17.
Pfeffer, W., deceased, 19.
Plant-sports produced at will (Rawson), 2; abstract, 64.
Pocock, R. I., appointed V.-P., 55; elected Councillor, 20.
Prankerd, Miss T. L., admitted, 54.
President (Dr. A. Smith Woodward), announcement as to 'Goodenough Fund' 7; appointed Scrutineers, 20–21; appointed Vice-Presidents, 55; elected, 21; on certain groups of fossil Fishes (Presidential Address), 25–37; on General Secretary's completion of 40 years as a Secretary, 37; on Ray Society publications, 18; on Sir J. Banks as a Trustee of the British Museum, *Suppl.*, 20–21; read proposed alterations in the Bye-Laws, 2, 3, 11, 13, 54, 56; read resolution *re* the enclosure of Wanstead Flats, &c., 17.
Presidential Address, 25–37.
Pugsley, H. W., elected, 18; proposed, 2; sec. reading, 16.

Ramana-Sāstrin, Dr. V. V., proposed, 19.
Rawson, Col. H. E., Plant-sports produced at will, 2; abstract, 64.
Ray Society, publications referred to, 18.
Removals from List by Council, 20.
Rendle, Dr. A. B., elected Botanical Secretary and Councillor, 20–21; *see* Baker, E. G.
Retzius, Prof. G. M., death announced, 9, 19; obituary, 47.
Revision of *Baphia*, Afzel. (Lester-Garland), 2.
Richards, R. M., proposed, 18.
Rosenheim, Dr. O., admitted, 56; elected, 54; proposed, 15; sec. reading, 18.
Rothschild, Lord, elected Councillor, 20.
Rowntree, W. S., appointed Scrutineer, 20–21.
Rubi, British, drawings exhibited (Trower), 4.

Saccardo, Prof. P. A., death announced, 11, 19.
Salisbury, Dr. E. J., elected Councillor, 20.

Salmon, C. E., elected Councillor, 20.
Sant, James, R.A., his painting of the first admission of women as Fellows, presented by Lady Crisp, 55.
Sāstrin, *see* Ramana-Sāstrin.
Schwendener, Prof. S., death announced, 9, 19; obituary, 47.
Scott, Dr. D. H., Councillor retired, 21.
Scrutineers appointed, 20–21.
Secretaries elected, 21.
Sedgwick, L. J., admitted, 9.
Sex and Soma (McLean), 4–5.
Shaw, F. J. F., admitted, 56.
Sheppard, A. W., admitted, 2.
Sibour, Louis Blaise, Vicomte de, proposed, 18.
Sim, Dr. T. R., elected, 10; proposed, 1; sec. reading, 6.
Skottsberg, Dr. K. J. F., Botanical features of Juan Fernandez group, 57–58.
Small, Prof. J., Chemical reversal of geotropic response in roots and stems, 16.
Smith, *see* Gardner-Smith, *and* Irwin-Smith.
Smith, Miss A. L., elected Councillor, 20; Lichens of New Caledonia, 14–15.
Smith, J. C., removed from List, 20.
Smith, Miss W., withdrawn, 20.
Soma, Sex and (McLean), 4–5.
Southee, E. A., elected, 3; sec. reading, 1.
Sowerby, G. B., withdrawn, 20.
Spouges, Fragrance of Calcinean; *Syncrypta spongiarum*; and notes on the physiology of sponges (Bidder), 18; volumes on, formerly the property of Prof. Minchin, presented, 6.
Spratt, Miss F., proposed, 57.
Squire, Sir Peter W., deceased, 19; obituary, 49.
Steindachner, F., deceased, 19.
Stephens, H. C., deceased, 19.
Sutherland, Dr. G. K., elected, 18; proposed, 5; sec. reading, 17.
Sutton, A. W., Councillor retired, 21.
Swanton, E. W., elected Associate, 17; proposed, 13.
*Syncrypta spongiarum** (by Dr. Bidder), 18.

Taylor, Miss B. B., elected, 3; sec. reading, 1.
Taylor, F. H., elected, 10; proposed, 1; sec. reading, 6.
Tembé, C. M., elected, 57; proposed, 18; sec. reading, 56.
Thaxter, Prof. R., elected For. Memb., 18; proposed, 13.
Thériot, I., Mosses of New Caledonia, 14.
Thompson, A. R., admitted, 5; elected, 3; sec. reading, 1.
Thomson, Miss M. R. H., elected 3; sec. reading, 1.
Tillyard, Dr. R. J., admitted, 57; The Cawthron Institute, 58.
Trail Award and Medal, received by Dame Helen Gwynne-Vaughan, 35.
Tráil, Prof. J. W. H., deceased, 19; obituary, 49–51.
Treasurer, Annual Report, 19, 22–24; elected (H. W. Monckton), 21.
Tremearne, Mrs. M. N., withdrawn, 20.
Trower, Miss, drawings of British *Rubi* exhibited, 4.
Turner, J. S., deceased, 19.
Tutcher, W. J., deceased, 19; obituary, 51.

Uppsala, proposed restoration of Old Botanic Garden and Carl von Linné's house, 57.

Vaughan, *see* Gwynne-Vaughan.
Vice-Presidents appointed, 55.
Vilmorin, J. de, elected, 15; proposed, 1; sec. reading, 13.
Vöchting, Prof. H. von, death announced, 9, 19.

Wager, Dr. H., Councillor retired, 21.
Wakefield, Miss E. M., Fungi of New Caledonia, 14–15.
Waldo, *see* Meade-Waldo.
Walsh, Col. J. H. Tull, elected Councillor, 20.
Wanstead Flats, resolution *re* the enclosure of, &c., 17.
Ward, Capt. F. K., exploration of the N.E. Frontier of Burma, 17.
Weiss, Prof. F. E., appointed Scrutineer, 20–21; motion on alteration in Bye-Laws, 16; moved the vote of thanks for President's Address, 35.
West, Prof. G. S., deceased, 19; obituary, 52.
Whaling in the Southern Ocean, lantern-slides shown (Dakin), 55.

White, J. W., withdrawn, 20.
Whitehead, A., showed lantern-slides of objects obs. near Basra, 55.
Wilson, J. C., withdrawn, 20.
Wise, W., withdrawn, 20.
Wishart, Dr. J., admitted, 56; elected, 54; proposed, 13; sec. reading, 18.
Withdrawals, 20.
Wolley-Dod, Col. A. H., proposed, 19.
Woodward, Dr. A. Smith, elected President and Councillor, 20–21.

Young, A. P., deceased, 19.

Zoological Secretary (Prof. E. S. Goodrich), elected, 21.

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PAPERS

READ AT THE

BANKS CELEBRATION

ON

THURSDAY, 17th JUNE, 1920,

IN

COMMEMORATION OF THE CENTENARY OF THE DEATH OF THE RT. HON. SIR JOSEPH BANKS, Bt., P.C., K.B., P.R.S.,

ON THE 19TH JUNE, 1820.

Forming a Supplement to the Proceedings of the Society for the 132nd Session, 1919–20.

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1920.

SIR JOSEPH BANKS

AS A TRAVELLER.

By B. Daydon Jackson, Ph.D., Gen.Sec.L.S.

I think that the first volume I read as a child for my own pleasure was an abridged account of Cook's Voyages, so that from a very early period of my life I have been familiar with Banks's adventures as a traveller. Since that time I have been occupied on four different occasions with the life of Banks.

(1) In 1876 the Keeper of Botany in the British Museum, Mr. W. Carruthers, suggested that I should undertake to draw up an account of Banks's life, from the material then in the Museum. The originals were only lodged with the Trustees, but it was understood that on the death of Lady Knatchbull the documents were to become the property of the Nation. Meanwhile I was given "temporary possession" of 23 folio volumes, copied from the originals just mentioned, by the daughters of Dawson Turner, whose handwriting was to be seen in places. I then had plenty of time and abundance of enthusiasm, and therefore set to work with great energy. The first two volumes contained Banks's journal of his voyage in the 'Endeavour,' 1760–71, and I made copious extracts from the narrative which so greatly interested me. For several months I continued my research, but gradually I found that the freshness and vigour of the journal had declined into the dry business statements of the official; I had lost the man, the human being, and found only the official recorder. I tried to remedy this by hunting for personal and private letters, but at that time the letters, which afterwards became available, were not to be found, and consequently my notes were laid aside, and not cast into a 'Life' which I felt would be destitute of human interest.

(2) These notes, however, were of great use afterwards, when I wrote the life of Banks for Leslie Stephens's 'Dictionary of National Biography.'

(3) Early in 1893 Sir Joseph Hooker spoke to me of his fruitless search after Banks's Journal, which he remembered his aunts copied for their father, Dawson Turner. I was able to assure him that this transcript was still in the Department of Botany, British Museum, and ultimately had the two volumes copied, which, after being edited by Sir Joseph, were published by Macmillan and Co. in 1896.

(4) Once more my notes were used for a life of Banks, this time by Mr. Edward Smith, which came out in 1911; by this time several volumes of letters written by Banks were available, and Mr. Smith made good use of this advantage.

Thus from infancy to age I have had before me the inspiring personality of Sir Joseph Banks, and am glad to take part in the present celebration of a remarkable man.

As I have to deal with the earlier life of Banks, I venture to prefix a few remarks on his birth and upbringing.

He was born in Argyle Street, a short distance from the room in which we are assembled, in February 1743, his ancestors being Lincolnshire people: his father, William Banks, who succeeded to the family estates in 1736; his mother, Marianne, daughter of William Bate. His school-days were passed at Harrow, whence after four years he was sent to Eton, where he earned the reputation of being devoted to play, but not addicted to books. From Eton he went up to Christ Church, Oxford. In 1761 his father died, leaving Joseph, still a minor, and a sister to the care of their mother.

At the time when Banks went up, the Professor of Botany was Humphrey Sibthorp, and as no lectures were delivered at Oxford, he arranged with Sibthorp to get a lecturer, which he accomplished by going to Cambridge, and bringing back with him Israel Lyons. Banks went down in December 1763, and in the following February he came of age, and established himself at Revesby.

In 1766 he engaged on his first voyage. An Oxford friend, Lieut. Constantine Phipps, afterwards second Baron Mulgrave, was on the 'Niger,' Capt. T. Adams, which was ordered to Labrador and Newfoundland on business concerning the fisheries. He suggested that Banks should accompany him, which idea was warmly entertained; the 'Niger' sailed on 22nd April, 1766, and reached Newfoundland 11th May; thenceforward Banks was busy on plants, birds, and fishes. The vessel made for Lisbon on her return, and reached that port on 2nd November, remaining there some weeks, enabling Banks to familiarize himself with Portuguese productions. In 1767 he made two trips inland, westwards, and to Wales.

The next year brought the great opportunity, which Banks seized. The Royal Society wanted accurate observation of the Transit of Venus, due in 1769, and arrangements were made for parties to proceed to Madras, Hudson Bay, and an island in the Pacific Ocean. James Cook, then a lieutenant in the Royal Navy, was chosen commander of the 'Endeavour,' a Whitby-built collier, and Banks, with Daniel Solander, and a staff of draughtsmen and servants, nine in all, were assigned quarters on board.

The 'Endeavour' left Plymouth on 25th August, 1768, and sailed to Madeira, where five days were spent; then it set its course to Rio de Janeiro, which was gained on the 13th November. On the way Banks and his company were constantly netting fish and marine animals and shooting sea-birds, describing and figuring those which were new to science.

The expedition was very badly treated by the Portuguese

colonial officers at Rio; the explorers were not allowed to land, but Banks went ashore one day before daybreak, and stayed till it was dark. After a fortnight's stay, the 'Endeavour' was fired upon for attempting to leave without permission; it turned out that the responsible brigadier had forgotten to send the permission, which had been written out some days before.

From Rio the voyage was continued to Tierra del Fuego, Banks and Solander landing on Staten Island. Two days later they ran the risk of perishing in the snow, a tale well known but worthy of being mentioned in its proper place. Solander, Banks, Monkhouse (midshipman), and Green (astronomer) set out to get well into the country and ascend the hills, which were bare of trees. On starting, the weather was much like a sunshiny day in May; on reaching the plains, they found the level surface consisted of low birch-bushes reaching waist-high, which formed the most tedious travelling. In the midst of this, Mr. Buchan, an artist, fell into a fit. A fire was lit for him, and the more active pushed on for the next hill. It was now very cold, with frequent snow-blasts, so all hope of getting back to the ship that day was given up, and they tried to get into the middle of a wood and to make a fire, Banks bringing up the rear. The cold increased, and Solander said he could go no further, but must lie down, which he did, in spite of all Banks could say. A black servant did the same. Banks now despatched five of the party to make a fire at the first convenient spot, whilst he and four remained to get Solander and the negro along. Both again laid themselves down to sleep, when the welcome news came of the fire lit a short distance ahead. Banks took charge of Solander, and left two hands to remain with the negro; after getting warmed, a party was sent back, but it was found impossible to get the sleepers forward; they were therefore covered with boughs of trees. One vulture formed the whole provision for the party.

The next morning the weather improved, and the party reached the shore in three hours, having made a half-circle. On getting on board, they numbered two invalids, and two had been lost.

The 'Endeavour' sailed hence towards Tahiti, and arrived there after three months' passage. The voyagers quickly found the natives adepts in theft, and during the whole time of the ship's stay this malpractice had to be guarded against. The climax was the theft of the astronomical quadrant, and Banks, as usual, had to be the thief-catcher; the temperature was 91° Fahr., but the activity of Banks resulted in all the parts being restored. It seems extraordinary that only one quadrant should have formed part of the equipment, as the whole object of the expedition depended upon that single instrument, which might well have remained undiscovered among the many natives who had taken parts of it.

The transit having been duly observed, the expedition left Tahiti after a stay of three months, and four months later made

New Zealand, which was sailed round, and finally left on 31st March, 1770, the ship heading towards Australia; Botany Bay was sighted, and soon after the first kangaroo was seen. Not long after this the ship struck upon a coral-rock, and by the moonlight her sheathing-boards and false-keel were seen to come away. Day brought calm weather, and the crew began to lighten the ship. By night the ship was almost afloat, but the leak was only kept under by all the pumps working. At last she was hauled off, and seemed to make no more water than when last on the rock. After his hard work Banks threw himself down for a rest, when the alarming news was reported that the water had gained four feet in the hold. All hands started again to work, and then it was found that the carpenter had made a mistake in sounding. At this juncture one of the midshipmen proposed the expedient of "fothering," by taking a sail and stitching handfuls of oakum and wool in rows; this sail was drawn under the ship, and the suction of the leak drew the loose materials into the gap, and stopped the flow of water.

The ship was next worked into a harbour, the mouth of the Endeavour River, where she was run ashore and her bottom repaired; the leak was found to be partly stopped by a piece of rock as large as a fist being stuck in it and broken off short. Finally, the ship was worked out through the barrier-reef by Cook's Passage. Java and Timor were passed, till Batavia was reached in October 1770. Sickness then broke out, and Banks, Solander, and Cook were prostrated by fever, the first victim to the climate being Monkhouse, the ship's surgeon. The requisite repairs to the ship being finished, they set sail on Christmas Day. Several of the crew died at Batavia, and many more before the Cape was reached; in turn St. Helena was visited, and on the 12th July, Banks landed at Deal.

It may be mentioned that not only Dr. Hawkesworth, but Lieut. Cook adorned their somewhat prosaic narratives with purple patches from Banks's more vivid accounts.

Sir Joseph Hooker's estimate of Banks's services on the Expedition are as follows:—"It needs no reading between the lines of the great navigator's [*i. e.* Cook's] Journal to discover his estimation of the ability of his companion, of the value of his researches, and of the importance of his active co-operation on many occasions. It was Banks who rapidly mastered the language of the Otahitans and became the interpreter of the party, and who was the investigator of the customs, habits, etc., of these and of the natives of New Zealand. It was often through his activity that the commissariat was supplied with food. He was on various occasions the thief-taker, especially in the case of his hazardous expedition for the recovery of the stolen quadrant, upon the use of which, in observing the transit of Venus across the sun's disc, the success of the expedition so greatly depended. And, above all, it is to Banks's forethought and at his own risk that an Otahitan man

and boy were taken on board, through whom Banks directed, when in New Zealand, those inquiries into the customs of its inhabitants, which are the foundation of our knowledge of that interesting people. And when it is considered that the information obtained . . . the fulness and accuracy of the description of the New Zealanders, even as viewed in the light of modern knowledge, are very remarkable. Nor should it be forgotten that it was to the drawings made by the artists whom Banks took in his suite that the public is indebted for the magnificent series of plates that adorn Hawkesworth's account of the voyage. Still another motive is that Banks's Journal gives a life-like portrait of a naturalist's daily occupation at sea and ashore nearly one hundred and thirty years ago; and thus supplements the history of a voyage which, for extent and importance of geographic and hydrographic results, was unique and 'to the English nation the most momentous voyage of discovery that has ever taken place,' and has, moreover, directly led to the prosperity of the Empire; for it was owing to the reports of Cook and Banks, and it is believed, to the representations of the latter on the advantages of Botany Bay as a site for a settlement, that Australia was first colonised." (Journal, pp. viii, ix.)

Sir John Pringle, President of the Royal Society, took Banks to Kew, and introduced him to the King; an audience was granted on the 10th August, when Banks and Solander had a long conference on their discoveries and marvellous adventures. A cordial friendship thus arose between George III. and Banks, which resulted in great benefits to Science, as you will be reminded almost immediately.

The friendship between Banks and Lord Sandwich, the Chief of the Admiralty, was increased by the success of this voyage, and so soon as the month of September in the same year another expedition was being planned, with two vessels under Cook. Banks readily consented to share in the expedition, and his preparations were on a still more costly scale than on the former voyage. But difficulties arose from the additions which had been made in the 'Resolution' to accommodate the naturalists, and ultimately all Banks's stores were removed from the ship, and he withdrew from the expedition. The Forsters, father and son, took his place.

The extensive preparations made by Banks were not, however, fruitless, for they were used for an expedition to Iceland on a ship specially chartered by Banks; it sailed on 12th July, 1772, with a party of forty persons. Passing down the Channel, they landed for two days in the Isle of Wight, touched at Plymouth, and then shaped a course for the Western Islands of Scotland. Whilst lying in the Sound of Mull, a chance meeting of friends revealed the fact of an island which had hardly ever been visited. A boat was equipped with two days' provisions, and Banks and his party made their way to Staffa, which was discovered in this

manner. Banks wrote a full account in his Journal, which was copied into several publications, thus bringing the island into notice.

On 28th August the vessel reached Iceland, and they remained a month on shore. Their tour took in many of the most remarkable features, as Thingvalla, the Geysers, Hekla, the Hvitae, etc. Banks was one of the first, perhaps the first, to ascend Hekla, which he did in a storm of wind, with frost on the ground, and cold enough to freeze the moisture in the air on their clothes. The return from Iceland was leisurely, and it was not till 19th November that Banks, Solander, and Dr. Lind left Edinburgh for London.

Once more Banks travelled abroad; in March 1773 he went to Rotterdam, and attended a meeting of the Batavian Society, where he spoke of his wish to undertake a voyage towards the North Pole.

This closed the career of Banks as a traveller, for his journeys through England, as to and from Revesby to London, are not adventurous enough to be ranked with his oversea experiences. At the age of 30 this chapter of his life closed, and the remaining forty-seven years fall within the province of my colleagues to narrate.

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BANKS AS PATRON OF SCIENCE.

By A. B. Rendle, M.A., D.Sc., F.R.S., Sec.L.S.

A very early instance of Banks's interest in the promotion of Science is found in his time at Oxford. Banks wished to learn something of Botany, but the teaching of Botany was apparently not one of the functions of the then Professor, Humphrey Sibthorp; however, he was pleased to approve a suggestion by young Banks that a lecturer or reader might be provided who should be remunerated by contributions from his students. No such person being available at Oxford, Banks rode to Cambridge to consult John Martyn, who was able to supply the want in the person of Israel Lyons, a mathematician and botanist of Trinity, from whose teaching Banks and his fellow-students at Oxford profited.

The long three-year voyage with Capt. Cook, suggesting to a mind keen on the pursuit of Natural History and quick to appreciate its application in the interest and for the delight of his fellow-men, the wonderful possibilities of botanical exploration in little-known parts of the world, supplied the stimulus for the numerous remarkably varied schemes and pursuits which lead us to regard Banks as a great patron of Science. On his return to England in 1771 Banks found himself already famous. He was introduced to the King, and a friendship began which was fraught with great benefit to Science and to humanity. The King habitually consulted Banks on matters bearing on the welfare of his people, and Banks was able to suggest or help forward useful schemes.

In the autumn of 1777 Banks took the large house in Soho Square (No. 32), which was his principal residence for the rest of his life, and which became the resort of students, who were free to consult the fine library, museum, and herbarium, and of all classes of persons interested in schemes of philanthropy or for the advancement of Science.

The French traveller and scientist, Barthélemy Faujas de Saint-Fond, writes ('Travels in England and Scotland and the Western Islands in 1784'):—

Banks's house was the "rendezvous of those who cultivate the sciences. They assemble every morning in one of the apartments of a numerous library, which consists entirely of books on Natural History, and is the completest of its kind in existence. There all the journals and public papers, relative to the sciences, are to be found; and there they communicate to each other such new discoveries, as they are informed of by their respective correspondents, or which are transmitted by the learned foreigners who visit London, and who are all admitted into this society. A friendly breakfast of tea or coffee supports that tone of ease and fraternity which ought universally to prevail among men of Science and letters."

Banks had been elected F.R.S. in 1766 at the age of 23. His election as President twelve years later indicates the position he had already attained in the scientific world. Though other names were suggested, there was a general opinion that no one was so well qualified to occupy the vacant chair, and Banks was elected practically unanimously.

Thus at the age of 35 Banks occupied the premier position in the scientific world, was *persona grata* at Court, possessed ample means, and a knowledge gained by actual experience of the resources, as yet largely untapped, of the globe. To these were added an attractive and powerful personality, good health, and an intense enthusiasm for doing things and getting things done.

It is to be regretted that there is no record of a long life of unremitting work and remarkably varied usefulness beyond what can be pieced together from the correspondence extending over more than 50 years, a copy of which is in the Department of Botany of the British Museum.

For 42 years Banks was President of the Royal Society; it has been said—he was the Royal Society. He ruled as an autocrat; but it would seem that on the whole he ruled wisely and acted in what he regarded as the best interests of the Society. During the early years of his occupancy of the Chair some friction arose between President and Secretaries. Banks was anxious to raise the standard of the Fellowship, and announced that he meant to watch over applications for admission. He freely expressed his opinion on the merits of candidates, and advised for or against their election at the time of ballot. The rejection of a number of candidates gave offence to some of the Fellows, and in 1783 the discontent came to a head in an effort by a strong party to supplant Banks, who was also accused of a lack of sympathy with the mathematical side of the Society's work. However, a motion, which was seconded by the Hon. Hy. Cavendish, "that this Society do approve of Sir Joseph Banks as their President, and mean to support him in that office," was carried by 119 against 42. After the election of a new Secretary a few months later, in which Dr. Blagden, who was supported by Banks, secured a majority of 100 (139 to 39) over the candidate put forward by the opposition, the meetings resumed their former peaceful character.

As regards our own Society—I was asked a few days ago, *à propos* of our present commemoration, what special connection Sir Joseph Banks had with the Linnean Society. The Royal Society, the British Museum, the Royal Gardens, Kew,—the association of Sir Joseph Banks with these is, or should be, generally known; but what special interest had he in the Linnean Society? Though Banks played an important part in the development of the three institutions above-named, with which his name has been associated, he found them all in existence. It is probable that had it not been for Banks the Linnean Society of London would not have come into being when and how it did.

After the death of Linnæus in 1778, his herbarium, other collections, and library passed to his son, who died five years later. Linnæus's widow, doubtless in the hope of securing a higher price than would have been given in Sweden, offered the collections and library to Sir Joseph Banks for the sum of 1000 gs. Banks, who had already a large herbarium, was not inclined to acquire them, but urged his friend Dr. James Edward Smith, a young man who was much interested in Botany, to purchase them, and Smith became, in 1784, the possessor of the whole of Linnæus's library, museum, and MSS. for the sum of 900 gs. In 1788 Dr. James Edward Smith founded the Linnean Society, and at the first meeting for the election of Fellows Banks was appointed one of three Vice-Presidents. Thus had it not been for the European fame which Banks had acquired as a liberal patron of Science, the original offer would not have been made, and had it not been for Banks's kindly interest in the scientific pursuits of a younger man the offer might merely have been declined. In either case the story of our Society would have been different, and its reputation as the home of the collections of the founder of systematic natural history might have been wanting. Thus the connection of Banks with our Society, though indirect, was of some importance.

Again, the Linnean Society is the principal medium in this country for the publication of work dealing with taxonomic botany, and Sir Joseph Banks, by his own travels and by initiating and encouraging work of botanical exploration in all parts of the world, did magnificent service towards advancing the study of systematic botany. At any rate, Banks was a liberal supporter of this Society; for instance, he bore the cost of the copper and engraving of the 20 plates in the first volume of the 'Transactions.'

In 1800 the Royal Institution was founded, the outcome of a suggestion by Count Rumford for popularizing Science by lectures and laboratory work. It was at Banks's house in Soho Square that the meeting was held at which the proposition was adopted.

Sir Joseph was also one of the seven gentlemen who met at Mr. Hatchard's shop in Piccadilly on 7th March, 1804, and founded a Society for the study of Horticulture, which subsequently became the Royal Horticultural Society. The Earl of Dartmouth was the first President, and Sir J. Banks one of the Vice-Presidents.

The Royal Gardens, Kew, had attained considerable importance under the Princess Augusta with the assistance of the Earl of Bute, a keen botanist who took an active part in developing the botanical side of the Gardens. On the death of the Princess in 1772, George III. maintained the botanical character of the establishment with even greater energy than his mother, the place of botanical adviser being now taken by Sir Joseph Banks, who was virtually through the greater part of his life Director of the Gardens. Banks conceived the notion of making Kew the depository of every known plant that could be useful or ornamental in a climate like our own, and collectors were despatched on numerous

expeditions to different parts of the world for plants and seeds. The names of some of these collectors will be familiar to us:—Francis Masson, who visited the Cape of Good Hope twice, Madeira, the Canaries, Azores, Spain, Tangier, and the Balearic Islands, and finally succumbed to the cold of a Canadian winter; Archibald Menzies, a young Scotch surgeon who came with an introduction to Banks from Dr. Hope, the Edinburgh Professor of Botany, and was appointed under Banks's directions naturalist to the expedition to the Pacific under Capt. Vancouver on the 'Discovery'—among his discoveries are the Californian Redwood (*Sequoia sempervirens*), and the Chili Pine (*Araucaria imbricata*); and George Caley, whom Banks appointed in 1801 to collect in New South Wales. Medical men and others residing oversea were also brought into correspondence and encouraged to send plants home. Among correspondents in the East were the brothers Russell at Aleppo, the authors of a History of Aleppo, König, Naturalist in the Carnatic to the East India Company, Dr. Roxburgh, the pioneer exponent of the Indian Flora, the Moravian Brothers Mission, and others.

Banks was the moving spirit in arranging and fitting out the expedition of the 'Bounty' in 1787, under Captain Bligh (a friend of Banks who had served under Capt. Cook), for transporting Breadfruit trees from Otaheite to the West Indies; and most explicit instructions were drawn up by Banks for David Nelson, the gardener, as well as for the general conduct of the expedition. The mutiny on the 'Bounty' after leaving Otaheite with the supply of Breadfruit is matter of history. Banks must have been bitterly disappointed at the tragic failure of the attempt, but he took the matter up again without delay, and in less than two years a second expedition was fitted out and 300 trees were safely landed both at Jamaica and St. Vincent.

Banks's ample means were an important factor in his success as a patron of Science. But though he used his means with discretion he was generous in helping others. For instance, Banks himself had been at considerable expense in preparing for Capt. Cook's second expedition of 1772, which he was to join on similar conditions to those in which he had previously accompanied Cook; but the arrangements fell through at the last moment. Dr. Lind, physician, traveller, and astronomer, who was to have formed one of the party, had also been at some expense which Banks offered to reimburse. "He told me," writes Lind to a friend, "that he looked on his estate as belonging to his friends as well as himself; that he held me as one of them, and begged me to command my share of it whenever I wanted it."

Through Banks's liberality Francis Bauer, the eminent Austrian floral painter who accompanied Baron Joseph Jacquin to England in 1788, was attached as draughtsman to the Botanic Garden at Kew, a post which he occupied for 50 years. Banks not only paid his salary during his own life but provided for its continuance after his death (see 'Delineations of Exotic plants cultivated in the Royal Gardens at Kew,' 1796.)

The name of William Herschel, the great astronomer, recalls another instance of Banks's power and willingness to help. Herschel was a singularly modest man whose work was in danger of being hampered through pecuniary difficulty. Banks prompted by Dr. Wm. Watson, a mutual friend, used his personal influence with the King, the result being that an appointment worth £200 a year was found for Herschel, who was also presently received at Court, provided with quarters at Windsor, and thus enabled to devote his whole time to his astronomical work. The correspondence contains a number of letters from Watson and Herschel to Banks, in some of which detailed accounts of Herschel's work are given, indicating that Banks's interest in his discoveries was by no means superficial but at times even critical. The following extracts from the correspondence bear on Herschel's appointment.

Wm. Watson to Sir Joseph Banks.

"Among the motives which have induced me to write to you, I will not conceal my wish that *you* may be the person to whom my Friend may be chiefly indebted for his success. It was you, who first mentioned him to the King, and occasioned the honourable invitation he received from him. Finish therefore, Dear Sir, the noble work you have begun, by an application to the King, the success of which I cannot doubt, and remember that you may feel hereafter the great satisfaction in having been the chief instrument in the honourable establishment of so ingenious and excellent a person, who has already done so much tho' fettered by his present profession, & from whom so much more may be reasonably expected, whenever his situation shall permit him the undisturbed exertions of his great abilities."

Bath, June 29, 1782.

Wm. Herschel to Sir Joseph Banks.

"Sir,

I have been in hopes of soon having the Honour personally to make my acknowledgments to you for the favour of your mentioning me to his Majesty in so advantageous a light, but till I have that opportunity will not defer by a few lines to return the sincerest thanks for your kindness. To it, is owing the gracious reception I have met with from his Majesty, who has provided for me so as to put it now in my power to devote all my attention to Astronomy and Optics. It will at all times be my greatest ambition to endeavour to render myself worthy of the patronage of Sr. J. Banks, and to prove with how much sincerity and respect I am

Sir,

Your most oblig'd and
most obedt. humble Servt.
Wm. Herschel."

Queen's Lodge,
Windsor, Aug. 26, 1782.

Among the many schemes with which Banks was connected was the Association for Promoting the Discovery of the Inland Districts of Africa. Useful pioneer work was done by this Society though at the cost of life and treasure. The most successful expedition was that to the Gambia under Mungo Park, a young medical man and protégé of Sir Joseph's, 1794–97; a second expedition under Park in 1805 to the Niger met with disaster.

Banks also secured the appointment of his friend Afzelius, a young Swede, as botanist to the Sierra Leone Company; and large collections were made during the four years of his stay, 1792–96.

In 1798 Mungo Park had been asked by the Government to join a surveying expedition to New Holland, but the matter fell through. The event was however the occasion of the introduction to Banks of Robert Brown in the following letter from Josef Correa de Serra, a Portuguese exile resident in London and an intimate friend of Banks.

"Soho Square, 17th October, 1798.

"Right Honble Sir,

I hope you will not take amiss, my interference in the subject of this note. Mr. Brown, a very good naturalist, who frequents your Library, where I have made acquaintance with him, hearing that Mungo Park does not intend to go any more to New Holland, offers to go in his place. Science is a gainer in this change of man; Mr. Brown being a professed naturalist. He is a Scotchman fit to pursue an object with constance and cold mind. His present situation is of Ensign and Assistant Surgeon in the Fife-shire Fencibles, previous to which employment he received a regular Litterary education at Edinburg. It is by his own desire that I take the Liberty of making you acquainted with his wishes; his modesty deterring him from writing to you himself.

I am sir most respectfully yours
J. Corrêa de Serra."

Two years later Brown was offered and accepted the post of Naturalist on board the 'Investigator,' which was being fitted out for a voyage of scientific exploration to New Holland under Capt. Flinders.

Ferdinand Bauer went as the botanic draughtsman. Brown returned in October 1805, and in January 1806 Sir J. Banks reports to the Board of Admiralty the extent of the collections, which were estimated as representing 3600 species of plants, besides other natural history collections, and 2064 sketches by Bauer. Banks also arranged that the salaries of Brown and Bauer should be continued in order to enable them to complete their work. "I will undertake," he writes, "to direct the progress of these gentlemen, to quicken them if they are dilatory, to assist

them when it is in my power and to report to their Lordships the progress made by each in his respective department once a year at least."

On the death of Dryander in 1810 Brown succeeded him as librarian to Sir J. Banks, and remained in charge of the library and herbarium until the death of his patron in 1820. At Banks's death it was found that his magnificent library of Natural History, his Herbarium, manuscripts, drawings, engravings and other collections had been bequeathed to the British Museum subject to a life-interest in them by Robert Brown, who however was empowered to cause the collections to be transferred to the Museum during his life-time. This transfer was effected in 1827, and the Botanical, or, as it was for many years known, the Banksian Department of the British Museum was established, under the keepership of Robert Brown, a lasting monument of the devotion of Banks to the Science of Botany in the pursuit of which he had travelled far, spent much and worked unremittingly.

BANKS AS BOTANIST.

By James Britten, F.L.S.

The position of Banks as a pioneer of scientific travel and as a patron of science generally has been so universally recognized and has been so summarized by the two previous speakers, that it might seem that there was little left to say about him. But there remains an aspect of his work which has only in comparatively recent times received the attention which it deserves, and which it has been thought might adequately form the subject of a few remarks on this occasion. That I should have been honoured with a request to say something about Banks as a botanist is due to the fact that I have for nearly half a century been intimately acquainted with the material supplied by the Herbarium of which his collections were the foundation.

It is by such intimate acquaintance, not only with the collections but with the other material contained in the Department of the British Museum which was at one time known as "the Banksian," that an adequate estimate of Banks's knowledge can be formed. Of that material an important item is the transcript of his Correspondence, in twenty-one volumes, by the daughters of Dawson Turner; the distressing history of the originals of this is set forth by Mr. Carruthers in a letter to Sir Joseph Hooker prefixed to his publication of Banks's Journal—itself printed from a similar transcript in the same Department.

To enter upon a description of the contents of these volumes would be beyond my present province: it must suffice to say that they include letters from leaders of science and art and from others whose names are prominent in the history of the period—1766–1819—which they cover. Botany of course holds its place among the subjects discussed in the letters; but the evidence scattered through his Herbarium and still more the MSS. in his hand relating to his travels and the plants then collected afford abundant testimony to the prominent position which that science—the first which attracted him—held in Banks's esteem and to the knowledge which he possessed, and it is especially to the MSS. that I propose to call attention.

Perhaps the most interesting are those connected with his voyage to Newfoundland in 1766. Of this voyage Banks kept a Journal, which, after the dispersal of his MSS. in 1886, came into the possession of the late S. W. Silver, a Fellow of this Society, at whose death it was purchased, with the rest of his library, by the South Australian Branch of the Royal Geographical Society of Adelaide. It was in two volumes; of the first of these, from April 7 to Nov. 17, we have in the Department of Botany a transcript by Banks's sister Sarah Sophia, made in 1772; the second of only nineteen pages, from his arrival in the Tagus at the latter date, contains nothing of interest. In the 'Journal of Botany' for 1904 I gave some account of the Newfoundland Journal, which is of considerable topographical and scientific interest and abounds in notes on the natural history of the island, and expressed a hope that it might be published; it would be a graceful commemoration of this centenary if the Linnean Society could see its way to such an undertaking, but this would probably be impracticable under present conditions. A MS. note in the Correspondence states that this is the earliest Banksian journal in existence.

Another MS. volume contains Banks's MS. list of the 220 plants collected—this is the earliest catalogue of Newfoundland plants, and as such is well worthy of publication. It is arranged in accordance with the Linnean system, and the habitat and locality of each species is noted; specimens of each are in the Herbarium, the sheets being endorsed by Banks with the locality in accordance with Linnæus's direction (Phil. Bot. p. 7). It appears from a note in his Journal that Banks also collected "a box of seeds" and a "box of earth with plants in it"; but these were destroyed in a severe storm encountered on the fifth of November "off the Western Islands" on the homeward voyage.

On his return Banks employed Ehret to make drawings of twenty-two of the more interesting of his plants; these, beautifully executed on vellum, are also in the Department of Botany. Five of them are reproduced in Aiton's 'Hortus Kewensis,' and on the original drawings of three is a note by Banks stating that they were taken from "dry specimens brought from Newfoundland."

I have dwelt on the Newfoundland collection at length because it gives more definite evidence of Banks's individual botanical attainments than is afforded by any of the later work in which he was associated with Solander, whose greater fame as a botanist has naturally overshadowed that of his patron, and to whom exclusively is sometimes attributed work for which the two men were jointly responsible. Thus the new species described in the second edition of Alexander Russell's 'Natural History of Aleppo' (1789) are generally quoted as of Solander, although Patrick Russell in his preface expressly states that the catalogue of plants was drawn up by both botanists. But the records of the Newfoundland expedition contain no indication of any co-operation on Solander's part, and show that Banks, at the age of 24, had already obtained considerable botanical proficiency.

In the year between the Newfoundland voyage and the departure of the voyage to the South Seas, Banks visited the west of England: the Journal which he kept during his excursion was acquired by Mr. Spencer George Perceval, who published it in the 'Proceedings of the Bristol Naturalists' Society' for 1898 (ix. 6-37).

From his school days at Eton, Banks had been interested in British plants; we are told that while at school he paid some women, "cullers of simples," to bring him specimens of each plant they collected, for which he paid them sixpence; that, finding at home an old torn copy of Gerard's Herbal, he took it back to Eton with him, and that while there he made considerable collections of plants and insects; his botanical studies were continued during his university career at Oxford. A letter from Lightfoot dated Feb. 27, 1766—the first of the transcribed Correspondence—shows that Banks was at that time in active correspondence with the writer and with other botanists; and Lightfoot's account of his own earlier visit to St. Vincent's Rocks may have prompted Banks to the investigation of the plants of that locality recorded in the Journal of the West of England excursion. Banks again visited the West in 1773—this time in company with Lightfoot on the way to and from their joint expedition to Wales. Of this journey Lightfoot kept a diary, which is printed in the 'Journal of Botany' for 1905, with four letters written later to Banks relating to plants collected on the occasion. The Herbarium contains specimens of the plants collected—among them some not mentioned by Lightfoot; the sheets bearing the names in Banks's hand and are endorsed by him with notes giving locality and date: thus of *Euphorbia Lathyris*, then first noted as a British plant, he writes: "I found this one plant among the Ligustrum on the south side of the Steep Holmes Island, but being hurried by the tide had not time to search for more." Writing of this expedition Lightfoot says: "I believe it may without vanity be said that few, if any, Botanical Excursions in Great Britain have exceeded our collection either in Number or Rarity of Plants."

It is generally stated that Banks made the acquaintance of Solander (who came to London in 1760) in 1767; but in the first letter of Lightfoot reference is made to the latter in a way which indicates that at that period at latest—the beginning of 1766—Banks had knowledge of him as a botanist. Solander became a Fellow of the Royal Society in 1764 and Assistant-Librarian in the British Museum in the following year, and it seems reasonable to suppose that Banks had met with him in one of these positions.

That Banks was thoroughly acquainted with Solander's botanical qualifications is evident from the fact that when, in 1768, he proposed to join the voyage to the South Seas in order to observe the transit of Venus, Solander was invited to accompany him as naturalist—it may be noted that the arrangements for collectors and collections were carried out entirely at Banks's expense, at an estimated cost of £10,000. He engaged as one of the artists Sydney Parkinson, a young Scotchman who had been commended to his notice by John Lee, the well-known nurseryman of Hammersmith. In 1767 Banks sent Parkinson to draw at Kew, and the drawings then made (on vellum) are in the Department of Botany. Banks expressed the greatest satisfaction with Parkinson's work during the voyage—"he behaved to me uncommonly well, and with unbounded industry made for me a much larger number of drawings than I ever expected." The total number made during the voyage was 955, of which 675 were sketches and 280 finished drawings. All the Australian and most of the New Zealand ones are sketches; those from Brazil, Madeira, Tierra del Fuego and the Friendly Islands are nearly all finished drawings; of the Java plants there are 44 finished drawings and 72 sketches: in a few cases Parkinson made both sketches and finished drawings of the same plant. On the back of the sketches are notes by Parkinson of the colour of the leaves, flowers, etc., and the locality is added by Banks.

As is well known, finished drawings from the sketches were made for Banks by various artists on the return of the voyage, during which Parkinson had died, and copper-plates were prepared for publication; from these a certain number of the Australian plants were reproduced in a volume published by the Trustees of the British Museum in 1900–1905; in the introduction to this I have given a detailed account of the history of the collections. Parkinson's drawings and sketches, with the finished drawings of other artists and impressions of the copper-plates, form a series of volumes in the Department of Botany.

The description of the plants collected during the voyage was of course the work of Solander, whose manuscripts—both the original draft and a fair copy prepared for publication—are in the Department; but we have also a list of the collections in Banks's hand, geographically arranged, in the order in which they were loosely placed in the drying books in which they were brought home: in this the species supposed to be new are indicated by

"mscr." appended to the name, and the number of specimens collected of each plant is indicated.

In the volume published by the British Museum I have attributed the names of species which have been adopted by various authors from the Solander MSS. to Banks and Solander jointly, although in many instances Solander alone was originally cited for them. The joint responsibility seems to have been recognized by their contemporaries: thus Smith, writing in Rees's *Cyclopædia* (under *Jasminum*), referring to what are usually known as the Solander manuscripts, speaks of them as the work of both; a similar indication by Patrick Russell has already been mentioned.

In 1772 Banks went to Iceland, accompanied by Solander and by J. F. Miller as artist; it would seem that he kept a journal of the voyage, but this cannot be traced. The specimens collected by him are, however, in the Herbarium, and there is a volume of memoranda in MS. connected with the visit, which includes a rough list in Solander's hand, wherein the principal plants obtained are described. Most of the sketches—11 in number—are endorsed by Banks with the name and locality.

After 1773, as the Correspondence more than once referred to shows, Banks was occupied by the consideration of a number of subjects, of which botany was only one. In 1766 he had become a Fellow of the Royal Society, in which he soon occupied a prominent position, and in 1778 was elected President. From this time his practical interest in Botany was mainly confined to his Herbarium, for the curatorship of which he secured in succession Solander and Dryander, to whose industry and knowledge its value is mainly due.

The Herbarium is indeed in some respects the greatest evidence of Banks's position as a botanist; it was not the formation of a man whose primary instincts were those of a collector but of one who knew the value and interest of what he acquired, and who was willing to allow others to share the treasures which he had secured. These included the large collection of drawings and MSS., of which a list is given in the official 'History' of the Museum Collections; among the latter are the series of volumes known as the Solander manuscripts—the work mainly of Solander and Dryander—which may be regarded as a key not only to the Banksian but to the Sloane collections, and form the basis of Aiton's 'Hortus Kewensis.' Among the herbaria secured by Banks are those of Herman, Clifford (on which the 'Hortus Cliffortianus' was based), Gronovius, William Houstoun, John Reinhold Forster and George Forster, Jacquin, Phillip Miller, and Loureiro. Among those who have testified to the value of the collections and to the readiness with which they were placed at their disposal may be mentioned Swartz, Thunberg, the elder DeCandolle, and Gaertner, who in his 'De Fructibus' (1788–1805) continually acknowledges his indebtedness to the Herbarium, from which he describes many novelties. The importance of the Herbarium is thus summarized

in a note by Gawler (afterwards Ker) in the 'Botanical Register' for 1817, with which this appreciation may well conclude: "The pre-eminence of the Banksian Herbarium has not been established so much by its extent or the number of celebrated ones incorporated with it as through the matchless skill and talents of those who have superintended the determination of the specimens and assisted in collating the whole with the Herbarium of Linnæus. To which we may add the having been passed in review by most of the eminent botanists of the day, by whom it has been resorted to from all parts as the touchstone for the essay of the synonymy of their intended works, and who have attested their presence by various suggestions and corrections on its leaves."

[Appendix.—The following remarks, derived from the records of the British Museum, are appended by the President, by permission of the Trustees.]

Sir Joseph Banks was a very active Trustee of the British Museum, and the extent of his interest and influence is shown by the diary of Mr. Charles Koenig, who was at first Assistant-Keeper, afterwards Keeper, of the Natural History Department of the Museum during the last decade of Sir Joseph's life. In this diary there are numerous references to consultations with Sir Joseph Banks and the confident acceptance of his advice. A few extracts will illustrate the diversity of the subjects with which he was concerned.

On July 13th, 1810, Mr. Koenig records that he has discussed with Sir Joseph the arrangement of the Greville Collection of minerals, just acquired by the Museum, and has devised a satisfactory plan. He adds that this "may be deemed preferable to the scheme lately proposed by M. de Bournon, of forming two collections of the same kind, the one for the man of science and the other for the stupid gaze of the visiting vulgar."

On November 22nd, 1814, "Sir J. Banks came to examine into the state of the insect room."

Early in 1815, Mr. Koenig began to improve the exhibited collection of fossils, and proposed that he and Mr. Baber should visit Germany to purchase specimens. On February 10th, 1815, the proposal was sanctioned, and Mr. Koenig was ordered to wait upon Sir Joseph Banks for his instructions.

Important fossils and minerals from foreign countries were continually sent to Sir Joseph Banks, who passed them on as gifts to the Museum. A jaw of *Mosasaurus*, from the Dutch anatomist, Dr. Peter Camper, was given in 1784, and this was followed by other specimens until, in 1815, some remains of the mammoth from Siberia, sent by the emperor of Russia, completed an important series of additions. Sir Joseph then asked

the Trustees for a duplicate pair of horns of the "Irish Moose" in exchange for his many benefactions, and the request was at once granted.

The possible increase of the natural history collection by exchanging duplicates then attracted the attention of the Trustees, and on January 13th, 1817, they gave to Mr. Koenig "permission to exchange specimens" provided that in each case he first obtained "the approbation of Sir J. Banks."

On December 12th, 1817, Mr. Koenig recommended the Trustees to purchase the pioneer geological collection of William Smith, and assured them that he had discussed the subject with Sir Joseph Banks, and "availed himself of Sir Joseph's superior insight into these matters."

The last reference is dated February 19th, 1820, when Sir Joseph presided over a small sub-committee at his house to consider the stuffing of animals.

Zoology, palæontology, geology, and mineralogy thus equally came within Sir Joseph's sphere, and he also dealt with the problems of museum technique.

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